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PUBLIC NOTICES.

HEATING.

The Commissioners of His Majesty's Works, &c., are prepared to receive TENDERS before 11 a.m. on Wednesday, 9th November, 1932, for LOW-PRESSURE HOT-WATER HEATING at the Ministry of Pensions Hospital, Rookwood, Llandaff, Cardiff.

Drawings, specification, a copy of the conditions and form of contract, bills of quantities and forms for Tender, may be obtained from the CONTRACTS BRANCH, H.M. Office of Works, King Charles-street, London, S.W.1., on payment of One Pound. (Cheques payable to The Commissioners, H.M. Office of Works.) The sums so paid will be returned to those persons who send in Tenders in conformity with the conditions. 9070

Belfast Harbour.

The Belfast Harbour Commissioners are prepared to receive TENDERS for the CONSTRUCTION and ERECTION of a STEEL SHED and COLLATERAL WORKS on the West Side of Dufferin-road, Belfast, in accordance with the drawings and specification, which may be had on application to the Consulting Engineer, Mr. T. S. Gilbert, M. Inst. C.E., Harbour Office, from whom copies of the specification of works, form of Tender and any information may be obtained.

Tenders, on the special form provided for the purpose, should be addressed to the undersigned, and must be enclosed in a sealed envelope, endorsed "Tender for Shed," and delivered not later than Monday, the 28th November, 1932.

The Commissioners do not bind themselves to accept the lowest or any Tender.

Preference may be given to firms who undertake to fabricate the steelwork locally, and Tenders should state whether or not the steelwork will be fabricated in Northern Ireland.

M. J. WATKINS,
General Manager and Secretary.

Harbour Office, Belfast,
17th October, 1932. 9067

County Borough of Swansea.

ELECTRICITY DEPARTMENT.

STRUCTURAL STEELWORK FOR POWER STATION BUILDING AT TE JOHN NORTH.

The Corporation invite TENDERS for the SUPPLY, DELIVERY and ERECTION of approximately 6000 TONS of STRUCTURAL STEELWORK and other INCIDENTAL WORKS, including Roof Covering, Glazing, Gutters, Rain Water Pipes, &c.

The works are unemployment relief works, and will be subject to conditions laid down by the Government Unemployment Grants Committee.

The Corporation will consider Tenders only from Firms who have carried out works of similar character and magnitude.

On and after 24th October, 1932, plans may be seen and general conditions, specifications, and form of Tender obtained, at the Offices of the Consulting Engineers, Messrs. Preece, Cardew and Rider, 8, Queen Anne's Gate, Westminster, S.W.1, on deposit of Five Guineas, which will be returned on receipt of a bona fide Tender (not subsequently withdrawn).

Additional copies may be obtained on receipt of £1 1s. for each copy, which will not be returnable.

Sealed Tenders must be received by the undersigned not later than Twelve Noon on the 14th November, 1932.

The lowest or any Tender will not necessarily be accepted.

H. L. LANG-COATH,
Town Clerk.

The Guildhall, Swansea,
21st October, 1932 9071

Government of Iraq.

HABBANIYAH FLOOD RELIEF AND STORAGE RESERVOIR.

TENDERS are INVITED by the Ministry of Economics and Communications of the Government of Iraq for the EXCAVATION of THREE CHANNELS, together with THREE CONCRETE CONTROL REGULATORS and other SUBSIDIARY WORKS, in the vicinity of the town of Ramadi and the River Euphrates. The cube of excavation is approximately ten million cubic metres.

(2) The Contract Documents and instructions to persons tendering may be inspected on and after the 25th day of October, 1932, at any of the following places, namely :—

The Ministry of Economics and Communications, Baghdad, Iraq.

The Iraqi Consulate-General, Qasr al Ali, Cairo, Egypt.

The offices of Messrs. Coode, Wilson, Mitchell and Vaughan-Lee, Consulting Engineers to the Government of Iraq, 9, Victoria-street, London, England.

(3) Documents can be obtained on and after the 1st November up to and including the 30th November, 1932, in accordance with paragraph (4).

(4) Firms desiring to Tender shall first pay 15 Iraqi Dinars and make a deposit of 3000 Iraqi Dinars in cash at the Government's Bankers, The Eastern Bank, Limited, either in London or in Baghdad. On production of the receipts for the above, they can then obtain copies of the contract, specification, and schedules from either the Ministry of Economics and Communications in Baghdad, or Messrs. Coode, Wilson, Mitchell and Vaughan-Lee in London. Copies of the drawings must be obtained through the latter firm against further payment as laid down in the "Instructions to Persons Tendering." A further deposit of 3 per cent. of the amount tendered less the above-mentioned 3000 Iraqi Dinars, will be payable on submission of Tender, as laid down in the "Instructions to Persons Tendering," the said deposits to be held as a guarantee of good faith of the tenderers. One Iraqi Dinar is equivalent to One Pound sterling.

(5) Tenders must be submitted to the MINISTRY OF ECONOMICS AND COMMUNICATIONS, Baghdad, and will be received up to Noon on the 16th day of January, 1933.

(6) Particular attention is drawn to Article 13 of the "Instructions to Persons Tendering," namely, that Tenders will only be accepted from firms of contractors who have previously executed works of a similar nature and magnitude. 9072

The Engineer

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Bridgwater Corporation.

WATER SUPPLY.
PUMPING MACHINERY.
CONTRACT NO. 1.

The above Corporation invite TENDERS for the SUPPLY, ERECTION, and SETTING TO WORK of an INSTALLATION of CENTRIFUGAL PUMPS, together with the necessary CRUDE OIL ENGINES, ELECTRIC MOTORS, and CONTINGENT WORKS.

Copies of the conditions, specification, and form of Tender may be obtained from the Consulting Engineer, E. A. Sandford Fawcett, C.B., M. Inst. C.E., at 53, Victoria-street, Westminster, S.W.1, on receipt of a cheque for Five Guineas, made payable to the Bridgwater Corporation. This deposit will be returned upon receipt of a bona fide Tender.

Sealed Tenders, endorsed "Tender for Pumping Machinery," should reach the undersigned not later than Twelve Noon on Monday, the 28th day of November, 1932.

The Corporation do not bind themselves to accept the lowest or any Tender.

H. BEDALE,
Town Clerk.

Town Hall, Bridgwater,
Date, 19th October, 1932. 9074

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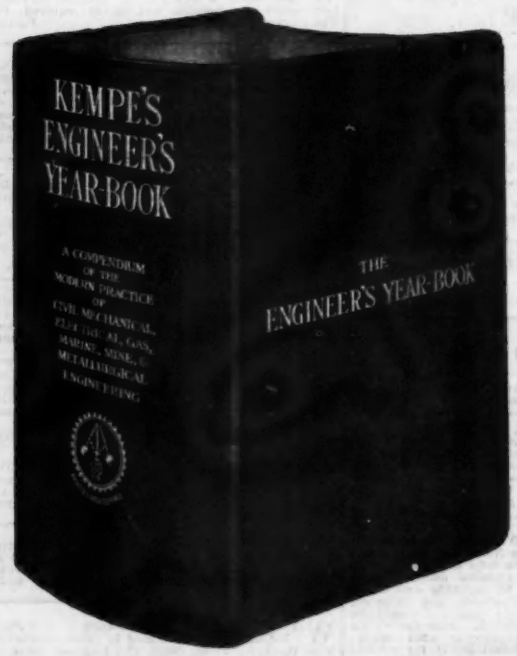
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The Aéropostale Company, which collapsed financially a year ago, and was aided by the State pending a reorganisation of its affairs, has lately suffered again from alleged irregularities, and this has occurred at a time when difficulties are accumulating in the air service between France and South America. The service has been continued for some years by means of aeroplanes to Dakar and by naval sloops across the South Atlantic to Natal in Brazil. The use of sloops was conditional on their being replaced eventually by seaplanes, since failure to organise a complete air service would invalidate the concessions obtained from different South American States. Moreover, the service by means of boats is too slow and costly. Several types of seaplanes have been built for the South Atlantic crossing, and experimental flights have been made, but they have all failed to show sufficient reliability for the service. Meanwhile, German airships have made ten voyages to South America and back during the year, and the last one is said to have covered all expenses, so that Dr. Eckener is preparing another airship in order to start upon a regular service to South America in the coming year. This is a serious matter for the Aéropostale, though the French refuse to believe that airships are suitable for the South American traffic at all seasons, and they believe that with reliable seaplanes they will be able to secure a monopoly of the postal and passenger traffic.

Railway Electrification.

An order called the Railway (Standardisation of Electrification) Order, 1932, has just been issued by the Minister of Transport. The Order follows the advice of the Railway Electrification Committee (1927) and provides that future schemes of electrification of standard gauge railways shall be on the D.C. system, and at a maximum voltage of either 1500 with overhead collection, or 750 with top contact third rail collection, subject to the power of the Minister to consent to a maximum voltage of 3000 with overhead collection in special conditions. Maximum loading gauges of electric locomotives are specified, and provision is also made for the standardisation of methods of collection and third rail and overhead equipment. Through-running of electric locomotives between the 1500-volt and 750-volt systems in the future is dealt with by a provision that when one-third of the steam locomotives of a company have been replaced by electric tractors, such electric locomotives as the Minister shall direct shall be equipped with lower voltage motors and series-parallel switching equipment, &c., so as to render them capable of through-running on both higher and lower voltage systems.

Research Appointments.

The Secretary of the Department of Scientific and Industrial Research announces that the Lord President of Council, has appointed Professor Alfred Fowler and Sir Clement D. M. Hindley to be members of the Advisory Council to the Committee of the Privy Council for Scientific and Industrial Research in place of Sir J. Alfred Ewing and Sir David Milne-Watson, who have retired on completion of their terms of office. Professor Fowler, it will be recalled, is a Past-president of the Royal Astronomical Society, Yarrow Research Professor of the Royal Society, and Professor of Astro-Physics in the University of London at the Imperial College, South Kensington. Sir Clement Hindley, a civil engineer and a member of the Council of the Institution of Civil Engineers, is a recognised authority on Indian matters, especially those relating to railways and port administration. It is further announced that Sir Harold Hartley, Vice-president of the London, Midland and Scottish Railway, and Director of Scientific Research of that railway, has been appointed Chairman of the Fuel Research Board, and that Dr. N. V. Sidgwick, of Oxford, is to be Chairman of the Chemistry Research Board of the Department of Scientific and Industrial Research in place of the late Sir Richard Threlfall.

The Ironbridge Power Station.

On the occasion of a luncheon held in connection with the official opening of the Ironbridge power station, on Thursday, October 13th, the Minister of Transport, Mr. Pybus, said that he understood that the station he was to start up in the afternoon was estimated to produce electricity at ¼d. per unit, including all capital charges, thus showing an efficiency that would stand comparison with that of generating plant made in any other part of the world. It was a commonplace to say that the best advertisement for business abroad was a highly efficient and economical example at home, and in these days, when generating units were so rapidly increasing in size, it was of the utmost importance that large plant, embodying research and new invention in one great unit, should be erected as frequently as possible. He had quoted the figure of ¼d. per unit for generation and he also had in mind the great reserve of current which would be provided. But he could imagine what some people in the towns and in the countryside served by the West Midlands Joint Electricity Authority would think when they became aware that the cheap electricity would not immediately become available to them. He could imagine a workman in some township or in the countryside looking up at the great high-tension networks which passed over his head and regarding them much in the same way as he regards the express train which never stops at his station. The workers in agriculture could not reasonably be expected to wait indefinitely for an abundance of cheap electricity, and it behoved engineers to devote all their energies to meeting the needs of those people.

The French Liner T.6.

With the approaching launch of the 75,000 gross ton French liner "T 6," which will take place on Saturday, October 29th, at St. Nazaire, we have received some further official particulars from the French Line concerning this interesting ship. She is, we are informed, to be named the "Normandie," and not the "President Doumer," as falsely reported some months ago. Her great length of 1027ft. overall is partly explained by her cruiser bow, which is of bulbous form, and is combined with a turtle-backed boat deck forward, having a vee-shaped breakwater. Her beam is 119ft. 6in. at the corbelled promenade deck, with a depth at this deck of 91ft. 4in., and a loaded draught of 36ft. 7in. The hull is divided into twelve water-tight compartments, and the double-bottom space will be utilised for fuel and fresh water tanks. There are eleven decks, of which five are continuous from stem to stern, while there are longitudinal bulkheads in the engine and boiler-room spaces with the usual double-bottom tanks. Accommodation will be provided for 930 first-class, 680 tourist, and 560 third-class passengers, which, together with 1320 officers and men, will make a ship's complement of 3490 persons. The machinery, which has been designed for a service speed of 30 knots, is turbo-electric, and is being constructed by the Alsthom works at Belfort. There are to be four turbines, aggregating 160,000 horse-power, which will drive 5000-volt alternators delivering current to the four propelling motors. There are to be twenty-nine 400 lb. pressure water-tube boilers of the type which has already proved successful in service on the "Champlain." The ship is designed to make the Atlantic crossing from Le Havre to New York, *vid* Plymouth, under all conditions, in something under five days.

The Normandie.

Accompanying the technical particulars with regard to the new liner "Normandie" referred to above, an important statement is made concerning the policy which has prompted the French Line to build the ship. Reference is made to French Government mail contract stipulations, which dictate that each successive ship shall be superior to, or at least equal to, foreign ships, which are either in service or in course of construction. The position in the Atlantic trade which prevailed at the time the ship was ordered is analysed, and it is clearly shown that in order to reply to British, German, and Italian competitors, it was necessary to foresee a ship that would be big and fast enough not to be outclassed as soon as she made her appearance, and to ensure an advance in design that could not be eliminated by the advent of a new rival. The company also points out that in 1934, when the ship will be commissioned, there will, of necessity, be a considerable decrease in large Atlantic tonnage, by reason of the obsolescence of various ships. The argument that a 30,000-ton ship would have met the requirements is dismissed on the ground that even if special steels and light alloys were utilised in her construction the hull would hardly be strong enough to withstand the stresses caused by about 90,000 S.H.P., which would be needed to propel her. Moreover, the company proceeds, it requires 25 per cent. less power per ton for a ship of 1000ft. to do 28 knots than for one of 750ft. to reach the same speed. With the lower power-tonnage factor the boiler and machinery spaces are proportionately less, with lower prime cost and maintenance and more reliability. These are some of the deciding factors which have led the French Line to build the new 75,000-ton electrically-propelled ship. Incidentally, they apply equally well to the new Cunarder, and support the progressive policy of the Cunard Company in laying down its new liner.

Colloidal Fuel for Marine Use.

In the course of an address given to the Chemical Engineering Group of the Society of Chemical Industry in London on Friday last, October 14th, Professor J. S. S. Brame, of the Royal Naval College, Greenwich, made reference to the coal-oil fuel which has been successfully tried out in the Cunard liner "Scythia," and said that many false hopes had been raised for a largely extended use of coal. For use on land it seemed unlikely, he continued, that coal-oil mixtures could compete, either with mechanical stokers or with pulverised coal. No opportunity ought, he thought, to be overlooked which might increase the use of home-produced fuel, but it was necessary, he felt, to guard against any exaggerated ideas of what the introduction of coal-oil fuel might mean to the coal industry. Any extended use of such fuel for the immediate future lay entirely in its application for steam raising aboard ship. Taking the merchant navy and the Royal Navy together, and assuming that nothing but coal-oil fuel were to be used, the increased demand for coal would only amount to approximately 1,000,000 tons, which was a very small increment in our total coal output of about 240,000,000 tons a year. Although the possibility of using colloidal fuels in oil engines had been foreshadowed, it was safe to say that for the present any such development was many years ahead.

The Lochaber Power Scheme.

On the afternoon of Saturday last, October 15th, a further stage in the completion of the Lochaber power scheme was reached, when the 3¾ mile tunnel between Loch Laggan and Loch Treig was finally broken through. The tunnel forms an important link in the second part of the scheme, which, besides the tunnel, includes the construction of two dams, one across the river Spean, and the other at the head of Loch Treig. It has a drop of 41ft. and the rock partition which was broken through on Saturday was about 1000ft. from the exit. Some 200 lb. of special explosive were employed and the shot was completely successful. The firing switch was closed by Mrs. Morrison, the wife of Mr. W. Murray Morrison, M. Inst. C.E., M.I.E.E., the originator of the scheme, and managing director of the British Aluminium Company, Ltd. After the smoke had cleared, the tunnel was inspected by the guests, who afterwards, together with the contractors and engineers' representatives, took part in a congratulatory luncheon. Messrs. Meik and Halcrow, of Westminster, are the engineers, and the contract is being carried out by Balfour, Beatty and Co., Ltd., of London. It may be recalled that an outline of the complete undertaking, with a detailed description of the first part of the scheme, was given in our issues of April 25th, May 2nd and May 9th, 1930.

The Coal Utilisation Council.

In the course of an address given before the Coal Industry Society in London on Monday last, October 17th, Mr. Evan Williams, the President of the Mining Association of Great Britain, outlined a campaign to secure the more general use of British coal in place of oil and foreign fuel substitutes. The Mining Association, the coal merchants, and the coal trades, had, he said, joined together and set on foot an organisation which would be known as the Coal Utilisation Council. The aim of the Council would be to sell more coal and to advise consumers how best to use it and what kind of apparatus to install. The Council had no quarrel, he said, with gas or electricity companies, but just as those companies had carried on an active campaign against the use of coal, it would be necessary for coal producers and distributors to enter into rivalry with them, to copy them, and to see whether they could not get more coal used in its raw state than was used at the present time. Pulverised coal could now be used almost as easily as oil, and road transport, if not hampered by duties and taxes, would provide a useful field for development in the extended use in commercial vehicles of steam instead of oil. On Monday last, the Coal Utilisation Council appointed Mr. W. R. Gordon as its director. He will undertake his new duties at the beginning of next month.

The James Watt Dinner.

The annual James Watt dinner of the Institution of Engineers and Shipbuilders in Scotland, which was held on Friday evening, October 14th, in Glasgow, proved in spite of trade depression a well-attended and interesting event. The chair was taken by Mr. Archibald Gilchrist, the President of the Institution, and the toast of "Engineering and the Empire" was entrusted to the Earl of Elgin, who spoke of the far-reaching influence of the modern engineer, in industrial and agricultural pursuits. Replying to the toast, Major Walter Elliott, Minister of Agriculture and Fisheries, dealt with the state of industry on Clydeside. The members of the Government, he said, were deeply concerned with the state of industry and employment at the present time, and realised how much the prosperity of the country was bound up with the prosperity of the great industry of engineering. They realised that an examination of the prospects of industry, both by the Government and by the captains of industry, more searching than had ever been made before, was needed. Mr. Richard Green, President of the Shipbuilding Employees' Federation, who also spoke, referred to the prevailing crisis, and stated that he had sufficient optimism to say that the country was winning through. He was confident that when the tide did begin to flow more strongly, it would be found that the technique and enterprises of the British engineer would place him in the very front rank and enable him to compete with anyone.

The New Water Supply Tunnel for New York City.

No. III. (*conclusion*).*

Mucking.

When shaft sinking was finished in 1930, the contractor brought to his aid additional equipment for work in the tunnel and for the disposal of excavated materials. None of this equipment could be safely placed in the tunnel until the headings had been advanced from 200ft. to 300ft. from the shafts by the use of shaft-sinking equipment. It took from five to six weeks to assemble the apparatus required to advance the headings further, and to execute the other preparatory work. The new equipment included headframes, shaft cages, electrically operated mine hoists, motor generator sets, drills and columns, tunnel excavating machines, muck cars, storage battery locomotives, motor trucks, ventilating blowers, pumps, &c. At each shaft there were sixteen 145 lb. drifter drills and four 120 lb. drifter drills. In equipping the shafts for tunnel driving, structural steel was used instead of timbering as far as it was possible to do so in order to safeguard against fire.

Some of the drifter drills that had been used in shaft sinking were fitted with frames so that they could be mounted on columns and employed in tunnel driving. The heavier drifters were provided especially for tunnel work. At one shaft there were self-feeding drifter drills, which required the attention of the drill runner only for pointing the drill and changing the steel. The drilling outfit at a heading was usually composed of five drills, mounted on arms on three columns and two drills, mounted on a horizontal bar, in front of the bench. Although some hand-mucking was unavoidable in clearing the heading and in removing scattered *débris* from the tunnel invert, still, wherever possible, the muck was disposed of by mechanical means. For this purpose there were twenty-seven steam shovels fitted with short booms and 1¼-yard buckets. The shovels were converted for air operation—Fig. 10 and Fig. 15 (see page 408).

Twenty-two of the shovels were mounted on double trucks and were operated on tunnel track of 3ft. gauge. They were arranged for side loading, and at the rear of each shovel frame there was an air-operated crane for picking up and swinging muck cars from the shovel track on to the parallel loading track. The five other shovels were mounted on single trucks, and, in some instances, were able to swing a full circle within the tunnel excavation. Generally however, they were also provided with cranes for shifting muck cars. In the early stages of tunnel driving, a machine resembling a dragline excavator was used to remove muck in three of the headings. Its essential parts were a long traveller built of structural steel, having an elevated platform at its centre, and from the rear of the platform was operated a dragline bucket to draw muck from a heading and to deposit it over dumping gates in the floor of the platform. At the proper time, the muck was dropped through the gated opening into cars standing on a track beneath. The forward end of the traveller was in the form of a ramp, made of steel plating, up and down which the bucket was drawn when loaded and when returning for a load respectively. A steel shelter at the rear of the platform contained the dragline hoist and motor. The machine was mounted on wheels and was moved on tracks laid on the invert muck. The cable operating the bucket was run to a snatch block hung on a steel pin driven into a drill hole at the heading. The position of the block was changed as needed to permit the bucket to reach all parts of the heading.

The dragline made it possible to start mucking immediately after firing at a heading, and, under favourable conditions, the machine was able to muck the tunnel quickly. However, the apparatus was subsequently displaced by shovels, which were found, in the long run, to be generally more satisfactory. At several of the shafts, dragline machines have since served efficiently in removing muck from the tunnel invert, and have been found better suited than shovels for the work. Muck has been and still is being removed from sections of the tunnel in side-dump steel cars of about 4 cubic yards capacity. Trains of three, five or six cars are hauled by storage battery locomotives. At the top of the shafts, the muck is dumped from the tunnel cars directly into motor trucks for final disposal.

* No. II. appeared October 14th.

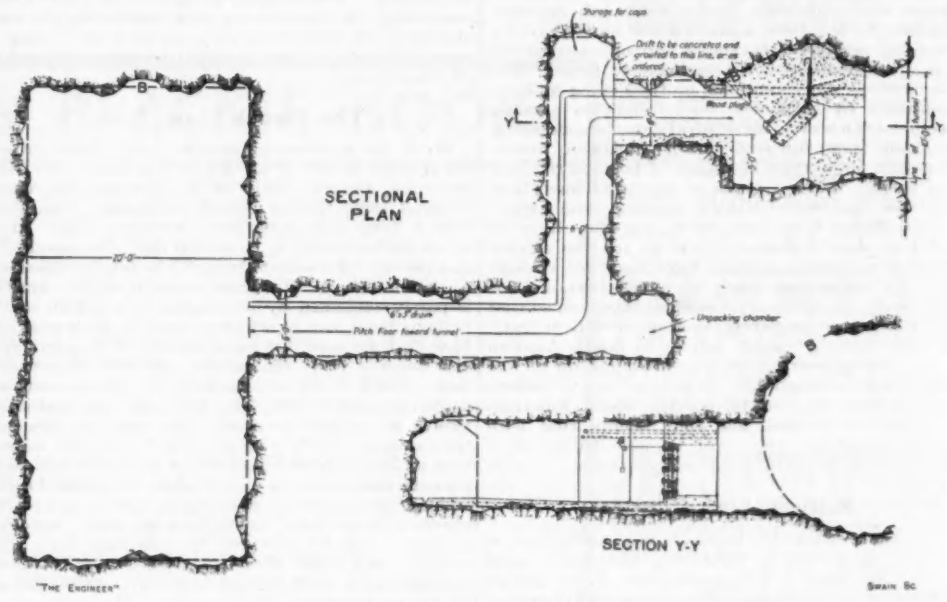


Fig. 9—Underground Magazine

ground magazine chambers were constructed and put into service. These chambers—Fig. 9—were equipped with heavy wooden storage shelves at one end. The air space in each chamber was designed to be large enough to provide for the neutralising of the accidental blast of 1000 lb. or 2000 lb. of stored explosives—depending upon the size of the magazine. At the tunnel outlet of the magazine there was hung a heavy reinforced concrete door that would be swung closed against the blast by the force of the blast. This safety provision was designed to give the workers time in which to reach the nearest tunnel shaft. A small outlet, stopped with a wooden plug, which would be blown outward by the blast, was counted upon to act as a vent for the gradual release of the gases from the chamber. There was a magazine at each shaft.

In driving the tunnel, the top-heading and bench method was generally employed, and the bench was kept as short as practicable, usually only one advance behind the heading. This plan was adopted to concentrate the muck and thereby to facilitate its disposal by the shovels. Where conditions were normal, three advances were made every working day at each shaft, two in one heading and one in the other. The weekly progress at each heading ranged from 75ft. to 100ft. The headings were usually drilled for four blasting rounds consisting of the cut, first and second relief, and line, aggregating about forty-six holes varying from 12ft. to 14ft. in depth. The bench was drilled from the face with sixteen horizontal or slightly inclined holes 12ft. deep.

The method of firing varied according to the

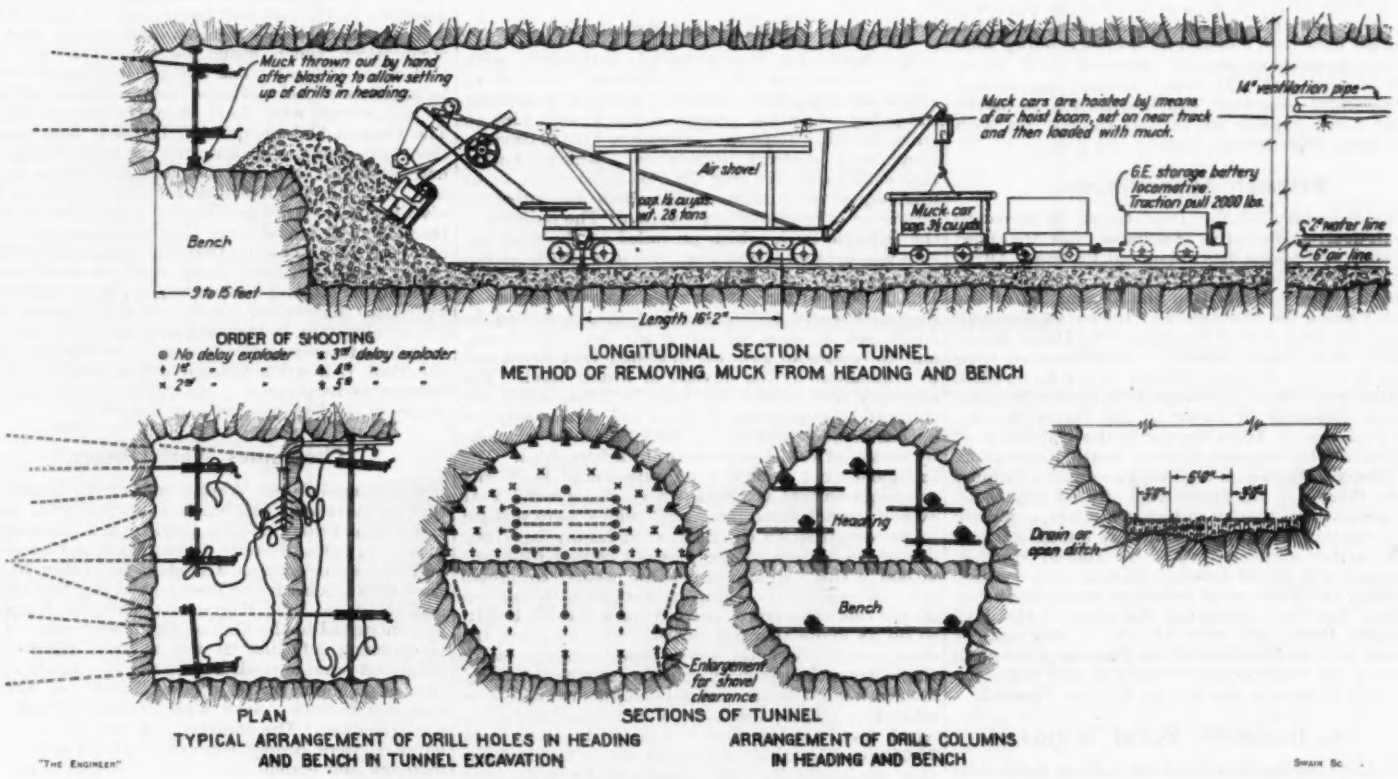

Muck thrown out by hand after blasting to allow setting up of drills in heading.
Air shovel
Muck cars are hoisted by means of air hoist boom, set on near track and then loaded with muck.
14" ventilation pipe
6E. storage battery locomotive. Traction pull 2000 lbs.
2" water line
6" air line
Muck car cap. 3½ cu.yds.
Bench
9 to 15 feet
Length 16'2"
ORDER OF SHOOTING
No delay exploder
1st
2nd
3rd delay exploder
4th
5th
LONGITUDINAL SECTION OF TUNNEL
METHOD OF REMOVING MUCK FROM HEADING AND BENCH
Heading
Bench
Enlargement for shovel clearance
Drain or open ditch
PLAN
SECTIONS OF TUNNEL
TYPICAL ARRANGEMENT OF DRILL HOLES IN HEADING AND BENCH IN TUNNEL EXCAVATION
ARRANGEMENT OF DRILL COLUMNS IN HEADING AND BENCH
"The Engineer"

Fig. 10—Drilling and Mucking

Blasting.

During the shaft sinking period and the early part of the tunnel-driving operations, the storage of explosives was necessarily at the surface of the ground. As soon as practicable, thereafter, under-

character of the rock. The practice of loading several rounds at one time and firing them separately by the use of delayed exploders was universal. Two methods of firing were used; first, loading the entire heading and bench and firing all at one time and using various degrees of delay for the successive rounds, or, secondly loading the cut and bench and firing them together with instantaneous exploders for the first shot and loading and firing the remaining rounds with instantaneous and delayed exploders. The time required to drill the sixty-two holes for one advance of heading and bench was from 6 to 6½ hours. The remaining 1½ or 2 hours of the shift was generally sufficient for the loading and firing. On the succeeding shift, in conjunction with steel at three different points. In short lengths of the tunnel at the foot of Shafts 2A and 3A north, the contractor supported the roof with the arch of the final tunnel lining resting on steel beams and posts, and in Shaft 13A north, an outer lining of concrete, extending from the rock to the inner face of the three-piece steel bents, was substituted for lagging and dry packing. Temporary timber was erected in short lengths of the tunnel, but its extensive use was avoided because the timber had to be removed before the tunnel lining reached it. At several places, where the tunnel is nearly parallel with the strike of the rock, and where the roof developed a tendency to break off in large slabs,

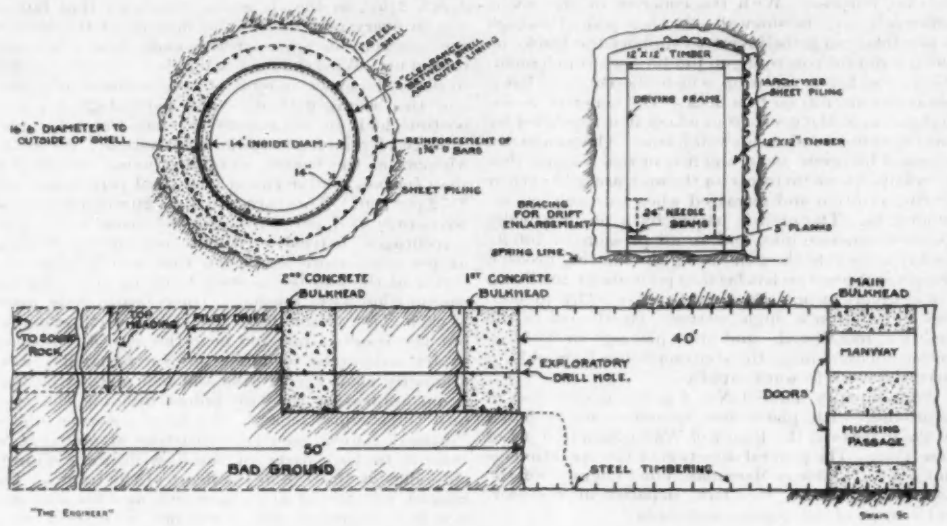


FIG. 11—TUNNELLING IN BAD GROUND IN THE BRONX

the tunnel was mucked out and the columns and drills set up for the next round of drilling. This routine was followed except when interrupted by shattered or decayed rock or large inflows of water. Bad ground and water under high pressure held up progress at a point under the Bronx River for something like six months. This incident will be referred to later.

ROOF SUPPORT.

Some form of roof support has been required in the majority of the tunnel headings. In some cases this support has been required for only short distances, but less frequently for decidedly long stretches. The sections of the tunnel driven northward from Shaft 8A and Shaft 12A required roof support for virtually their entire length. Of the several types of support used, the one generally employed was a modification of a three-piece structural steel bent, such as is shown in one of the engravings in the Supplement. Where the roof was not considered heavy but from which there was a continual spalling of small pieces of rock, a support consisting of pressed steel plates bolted to semi-circular ribs of structural steel was occasionally adopted. This design, while fairly satisfactory, depends for its stability on the thoroughness of the dry packing, and, in the end, it was found to be no more economical and more difficult to erect than the light three-piece structural steel support which was adopted later. Concrete was used the rock was securely blocked to the steel ribs, and some of the lagging and all the dry packing were omitted. The concrete lining in these instances extends through the support to the rock, and entirely encases the steel.

WATER.

Water was encountered in many of the headings, and in some instances the flow was so great as seriously to impede progress. In such cases it was the practice generally to attempt to cut off the flow by injecting grout into the rock ahead of the excavation. This plan was usually effective when the water-bearing seams were first penetrated during the advance of the heading. As soon as a drill hole indicated the presence of a large amount of water, the tunnel driving was stopped and several holes were drilled in an effort to tap the water-bearing seam at a number of different points. Gated pipes were driven into those holes and neat cement grout was forced into the rock under pressures of from 300 lb. to 500 lb. per square inch. Although the inflow was not in every instance entirely cut off by this means, still it was generally reduced so that the invert drains and pumps could dispose of it easily. At times grouting was successful for only short distances beyond the face of the heading, and the same water-bearing seam or a tributary to it was tapped when the heading had made a few more advances. When this occurrence happened, the grouting process was repeated at each new point of inflow. Inflows of 1000 gallons and more a minute have been dealt with in this manner, and by grouting successively eight times in a single heading, the amount of the incoming water was reduced about 80 per cent.

Probably the most difficult task in shutting out water and in consolidating the ground so that the tunnel could be carried forward occurred between Shafts 2A and 3A. This section of the tunnel runs beneath the Bronx River, Shaft 2A being 766ft. deep and Shaft 3A being 648ft. deep. The tunnel at the point in question lies quite 500ft. below the surface of the stream. The troublesome rock was a pegmatite dike lying between the limestone and the gneiss formation. The pegmatite was generally disintegrated with blocky remnants of the original rock scattered through the dike. The contractor was not unprepared for bad ground, because exploratory borings made along the tunnel line before work was started indicated the nature of the ground under the river, and he was therefore more or less ready for the battle when the time for action arrived on July 15th of last year.

As soon as the tunnel entered the faulted area, the contractor altered his procedure by enlarging the excavated section to a diameter of 24ft., and the steel timbering was formed accordingly. At the same time the steel supports for the roof were advanced virtually to the face of the heading. While drilling for a round in the heading on July 15th water issued forcibly from the cut holes, and at once the contractor recognised that there was probably difficulty ahead of him. Accordingly, he erected a concrete bulkhead across the heading and extended it back to the edge of the bench. A week later, a 4in. diamond drill was driven through the obstructing bulkhead for the purpose of grouting, in an effort to stop the flow of the water; but when the drill penetrated a distance of 40-odd feet, it tapped still more water. For days, holes were drilled to depths of from 60ft. to 85ft., and through each hole grout was forced into the ground ahead. The water was checked, but the incoming volume still remained disquieteningly large.

On August 5th, an exploratory hole, nearly 200ft. in depth, was driven from the first hole drilled in the bulkhead, and the drilling revealed that the bit had penetrated deeply into the Fordham gneiss lying ahead and beyond the pegmatite dike. Incidentally, the grouting had served so far to reduce the flow of water as to make it reasonably safe to demolish the bulkhead and to resume tunnel driving during the last week of the month. The outlook remained favourable only for a brief while, and by way of a provision against what seemed imminent, the contractor built a concrete bulkhead large enough to block the full section of the tunnel—see Fig. 11. The bulkhead, which was 11ft. thick, was erected about 40ft. back from the face of the bench, and was provided with two openings, a manway, 3ft. by 5ft. in the upper half, and an opening, 6ft. by 6ft. in cross section, for handling muck in the lower half—see Fig. 17. Each opening had a steel door on the advance face of the bulkhead, and pipes for draining and grouting ran through the structure for use when needed. With the completion of this defensive bulwark, tunnel driving was started again in the heading, and carried forward approximately 20ft., when conditions became so menacing that a second heading bulkhead was built so that further grouting could be done in the ground ahead. When the ground was considered sufficiently consolidated, the heading bulkhead was broken through and a timbered pilot drift was advanced for exploratory purposes, a sandbag bulwark being built near the face of this drift.

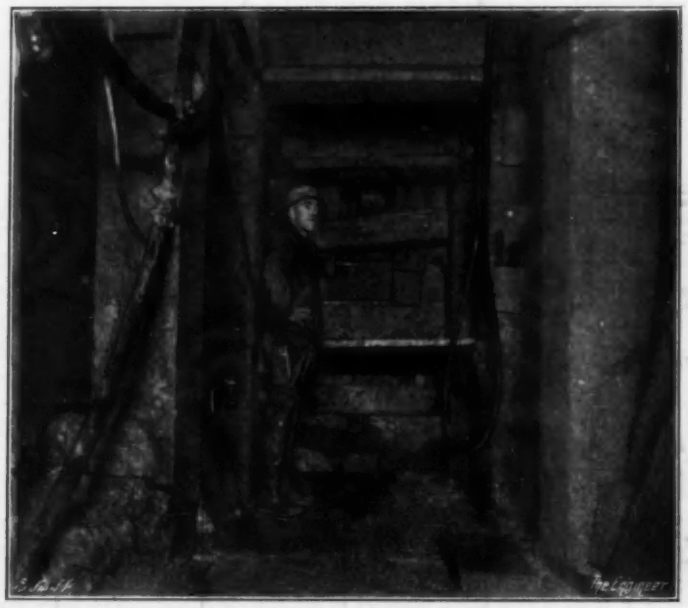


FIG. 12—TOP-CENTRE DRIFT UNDER THE BRONX RIVER

FIG. 13—STEEL FRAME CARRYING THREE AIR HAMMERS

On October 6th there was a sudden surge of muddy water from the pilot drift that was strong enough to carry away the wall of sandbags, and immediately afterwards the muck door in the main bulkhead was closed. The space between the main bulkhead and the heading soon filled, and the flow of water through the manway in the main bulkhead was of a volume that called for the full capacity of the available tunnel pumps. When the upper door in the bulkhead was shut on the following day and work stopped, a gauge on one of the drain pipes of the bulkhead indicated a hydrostatic pressure of 250 lb. But for the interposed bulkhead, the tunnel might have been flooded for miles to the southward. Not only that, but the emergency structure probably prevented the subsidence of the ground hundreds of feet above where there is a new highway bridge and the tracks of a great railway system. The question was how to get through the bad ground, while holding both the water and the water-soaked ground at bay.

When the upper door in the bulkhead was opened, and the water permitted to pour out, the remainder of the chamber was found filled with silt. A pipe was forced forward toward the heading and a second pipe was inserted just inside the chamber. Through the longer pipe grout was discharged and through the shorter one sand and gravel were forced into the chamber, the object being to cause the sand and gravel to reduce the hydrostatic pressure on the bulkhead while grout was being delivered later into the chamber. In the end, the chamber was filled and the cavity above the pilot drift was charged full with grout. The unstable ground above the spring line of the tunnel was consolidated by numerous radiating holes drilled upward through the main bulkhead. These holes served to carry some thousands of barrels of grout into the water-bearing formation. When the foregoing grouting had done its work, the steel door in the lower half of the bulkhead was removed by torch, so that the chamber could be excavated below the spring line. The grouting had been done at a maximum pressure of 700 lb., but, even so, the silt in the lower half of the chamber had resisted penetration by the grout. When the chamber was cleared out beneath the spring line the bench was drilled with diamond drills,—the holes radiating sidewise and downward—and the chamber became the base of further operations.

The object was to drive a 7ft. by 12ft. top heading to solid rock, and then to enlarge this heading to the designed full size, and, finally, to take out the bench. To drive the top heading, steel sheet piling was driven above the arch of the heading and horizontally along both sides. This work had to be done inside the steel timbering that had already been put in place up to the face of the temporarily abandoned heading. The space between the main bulkhead and the bench was ample for handling the 30ft. steel sheet pilings while setting them in position and during their driving. A heavy timber driving frame was built in the top heading to serve as a template and to support the pneumatic pile hammers. This frame was securely anchored to the heading floor, and three powerful hammers were used to drive the arch-webbed piles. The heading was advanced slowly and cautiously and the piles were driven as soon as the way was cleared for them. Timbers were erected to carry the sheet piling immediately after the rock was removed, and, as a safeguard against any sudden inward movement of the pegmatite, a breasting was provided at the head of the drift. All told, sheet piling was driven a distance of 50ft., and 20ft. lengths were spliced to the 30ft. piles after the longer sheeting had been advanced the full length.

The crucial task was that of advancing the top heading well into the gneiss; with that done, the succeeding work was relatively easy. To facilitate the enlarging of the drift to the full tunnel section above the prescribed spring line, 24in. I beams, one on each side within the driving frame, were placed on the timbered floor of the drift to give the requisite support for the full section—see Supplement, Figs. 19 and 20. Again, sheeting was driven to conform to the full arch and a steel frame, the size of the full section of the tunnel, was built to serve as a guide for driving a complete circle of sheet piles. The double-acting pile hammers were mounted on the outer rim of the driving frame, and were moved in arc by means of chain blocks. One of our engravings shows this driving frame and the surrounding sheet steel piling.

In its finished form the tunnel section through the fault is of great strength, so that it may withstand the pressure of the high head of water that will flow through it and at the same time be virtually a great tubular girder spanning the stretch of soft ground of the fault. The internal diameter of this section of the tunnel is 14ft. instead of 17ft., and the walls are therefore 5ft. thick. The excavation line, marked by the outer circle of sheet piling, is followed by 2ft. 3in. of concrete lining reinforced with about fifty longitudinal 1¾in. twisted square bars spaced 1ft. between centres, and with 1in. twisted square bars formed into hoops spaced 7ft. apart—see Supplement. The inside face of this lining is in contact with a steel pipe, 16½ft. in diameter, that was formed of 1in. boiler plate. The plate is butt-jointed and assembled in sections about 46ft. in length; and the sections are connected by flanges formed by 4in. by 4in. by ⅝in. angles on the inside of this big tube. The tube is lined with concrete 14in. thick, and any space between the reinforced concrete tunnel lining and the steel tube has been filled with grout under high pressure. It is easy to understand how the situation in the section mentioned virtually precluded progress at that point for half a year; and only the resourcefulness of the men in charge prevented a disaster and made ultimate success possible.

Concreting.

The method of placing the concrete lining in the tunnel is similar to that commonly pursued in other large tunnels in the United States, and is virtually standardised. The usual procedure has been to pour the lining of the invert first, using special metal forms for that purpose. With the concrete of the invert sufficiently set, the sidewalls are then poured as high as possible, using the invert to support the tracks on which is run the concrete-gun jumbo—see Supplement. The jumbo has a ramp up which the concrete-laden dump cars are run on to a deck. The concrete is discharged on to the deck, from which it is shovelled by hand into the wooden sidewall forms. The jumbo can be raised by screw jacks, and it is in this manner that the collapsible metal forms for the arch are held in their pouring position and retracted when the arch has set sufficiently. The arch is placed by a pneumatically operated concrete gun, and an air pressure of 100 lb. is used to operate the gun during the blowing process. The general practice has been to pour about 200 linear feet of invert at one time, and to place 127ft. of sidewall and arch in a single section. By the use of the facilities mentioned, and by placing such large sections of the lining, the contractor has been able to carry the work forward rapidly.

Work on City Tunnel No. 2 is being executed in accordance with plans and specifications prepared by the experts of the Board of Water Supply, City of New York. The general direction of the operations is under Mr. Thaddeus Merriman, chief engineer of the Board, Mr. Charles M. Clark, department engineer, and a corps of engineering assistants.

Duration of Reinforced Concrete Railway Underbridges.

By J. D. W. BALL, Assoc. M. Inst. C.E.

More than twenty years have elapsed since reinforced concrete was commonly introduced for railway constructional purposes, and comparatively little has been heard with regard to the results obtained. As railway underbridges of any size, constructed of reinforced concrete, are comparatively rare, examples must be sought among culverts or small bridges. A considerable number of the reinforced concrete culvert superstructures illustrated in Figs. 2, 3, and 4 were constructed for one of the South American railways from 1913 onwards. The clear span is 2 m., and the superstructure, for a single track, consists of eight equal precast beams, six under the sleepers, and the lateral beams set on one of their sides to serve as parapets. The beams have a total percentage of reinforcement of rather more than 3 per cent., divided approximately equally between the tension and compression parts of the beam. This is an economical arrangement if the calculations are based upon 15, as the modular ratio of steel to concrete; but the regulations governing the construction of these culverts indicated 10 as the correct value of this ratio, in which case about 2 per cent. of the steel ought to be placed near the top of the beam and only 1 per cent. in tension, in order that the allowable working stresses in the concrete and in the steel should be developed simultaneously.

Accordingly, some tests were made with the object of determining which was the better arrangement. The test beams, which are shown in Fig. 1, were relatively short, the span being 15in. and the effective depth 2¼in., so that it is not surprising that failure was in every case due to the slipping of the rods in the concrete in spite of the ends being partially turned up. With the rods available it was not possible to place the exact amount of reinforcement required, and the beams with an equal percentage top and bottom had an advantage in that the total percentage of reinforcement in them was 3·1 per cent., whereas in the beams containing more compression than tension reinforcement, the total percentage was 2·72 per cent. This excess of steel gives a theoretical advantage of 7 per cent., but the beam with equal percentages carried, without completely failing, 54 per cent. more load than that which broke the better of the two beams with twice as much steel in compression as in tension. Three beams were made of each class. Some were tested in a small machine, but the results came too near the zero of the scale to be accurately readable, so the remainder were gradually loaded with rails and fish plates, the load being applied at the two points dividing the span into three equal parts. The beams were made of Portland cement mortar, consisting of one part of cement to two parts of sand, with some granite chippings of ¾in. size in the heart of the beams. The cement was tested in compression and tension, and it is to be regretted that it was not of better quality. Neat cement briquettes after seven days broke at 225 lb., 315 lb., and 215 lb. per square inch, average 252 lb. Mortar briquettes of the same age broke at 166 lb., 91 lb., and 85 lb. per square inch, average 114 lb. A mortar briquette tested at an age of two months, broke at 230 lb. per square inch. The best compression test with 3in. cubes of 1 : 2 : 3 mixture was 1640 lb. per square inch after one month.

The results of the tests on the beams, which were loaded with rails and fish plates, 80 days after manufacture, are given in the table on the next page.

As indicated in Fig. 4, the beams for the culvert superstructures were cast with six steel rods of ¾in. diameter for the compression reinforcement, equal to 1·75 per cent., and four steel rods of 1in. diameter for the tension reinforcement, equal to 1·52 per cent. These culverts have now been in existence for a period of fifteen years or longer, and while a large proportion of the beams have remained intact, with the exception of fine cracks, for some few years now repairs have had to be effected to one or more of the beams in some of the culverts, to replace fillets of concrete which had burst away from the lower edges, leaving parts of the tension reinforcement visible.

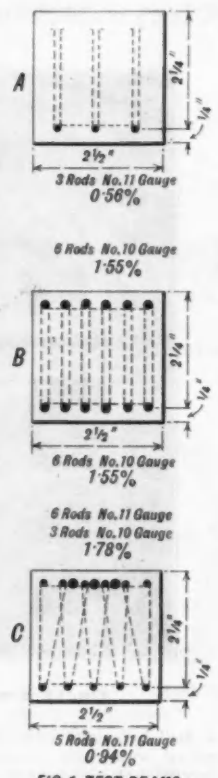


FIG. 1 TEST BEAMS.

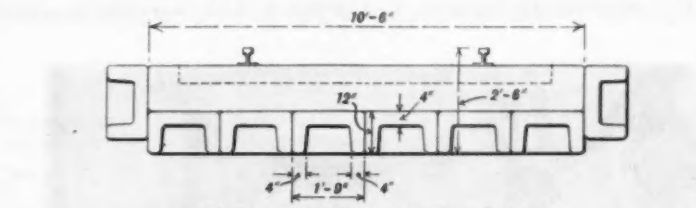


FIG. 2 SUPERSTRUCTURE OF 2 METRE CULVERT.

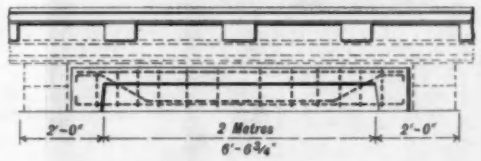


FIG. 3 LONGITUDINAL SECTION OF 2 METRE CULVERT.

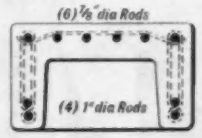


FIG. 4 R.C. BEAM FOR 2 METRE CULVERT.

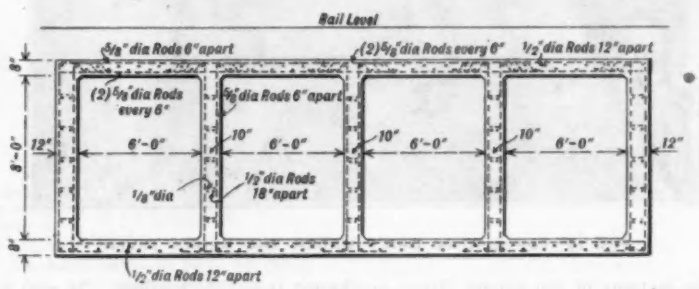


FIG. 5 SECTION OF REINFORCED CONCRETE CULVERT.

"The Engineer"

The probable causes of the defect indicated are :—(*a*) Insufficient working of the mixture in contact with the mould, to obtain an impermeable surface free from blow-holes ; (*b*) condensation of moisture in naturally damp situations on the underside of the beams ; (*c*) increase of volume, due to corrosion of the reinforcement, exerting bursting pressure on concrete ; (*d*) which eventually comes away under the vibration caused by railway traffic.

From inquiries made, it seems that similar defects have been noted from time to time in reinforced concrete structures under the railways in this country, and no great difficulty has been met in making good such defects.

To provide for future maintenance and reduce the number of units to be kept in stock, the parapets of the culverts—Fig. 2—were made interchangeable with the ordinary beams. In some cases a defective beam was replaced by one of the parapets and repaired to take the place of the parapet removed. In other cases, where there was no Sunday traffic or a long interval between week-day trains, the defective beams were repaired in position by cutting away the concrete around the visible reinforcing bar to obtain the necessary clean surface and key, winding iron wire loosely round the bar, and making good with a rich mortar of Ferrocrete and sand. When there was an insufficient interval between trains to permit of this procedure, and more than one beam required repairing, the load was taken off the reinforced concrete superstructure by supporting the track on nests of rails, as shown in Fig. 3, by the dotted lines.

Fig. 5 shows another culvert or series of culverts, constructed about 1914 to carry a branch line over a stream. The box type of construction indicated was adopted on account of the bad foundation. The crossing being on the skew, each of the four sections was constructed with a square end projecting beyond the preceding one. As this construction consists entirely of slabs of monolithic concrete, there are no projecting parts to break away.

Reinforced concrete footbridges and arched highway bridges, constructed about the same time, have given no trouble, except in one case where unexpected subsequent pumping operations for brine caused some settlement, necessitating the strengthening of the foundations. Station platforms constructed of slabs of reinforced concrete, supported on reinforced concrete piers, have stood up well, in spite of the rough usage to which such structures are liable.

Tests on Reinforced Concrete Beams.

	Load, in lb.	Stresses in pounds per square inch.					
		Assuming ratio of elasticity 15.			Assuming ratio of elasticity 10.		
		Tension in steel.	Compression in concrete.	Bond stress.	Tension in steel.	Compression in concrete.	Bond stress.
Beam A_1, first crack	908	36,300	1,210	214	35,100	1,380	207
,, A_1, failed	1,223	48,900	1,630	288	47,500	1,870	280
,, A_2, first crack	790	31,600	1,050	186	30,600	1,200	180
,, A_2, failed	917	36,700	1,220	216	35,500	1,400	209
,, B_1, cracked without failing	2,750	38,500	1,750	257	40,000	2,200	267
,, C_1, first crack	1,552	36,300	1,040	214	36,000	1,330	212
,, C_1, failed	1,784	41,700	1,200	246	41,400	1,530	244
,, C_2, first crack	1,409	33,000	950	195	32,600	1,210	192
,, C_2, failed	1,598	37,400	1,070	221	37,100	1,380	218

The Site of Newcomen's Engine of 1712.

In a carefully argued paper read before the Newcomen Society on October 19th, Dr. T. E. Lones advances strong reasons for accepting Bilston as the actual place in which Newcomen's famous engine of 1712 was erected. After pointing out that "near Dudley Castle," the only hint as to its position given on Barney's well-known print, might mean anywhere in sight of the Castle, Dr. Lones goes over a map of the area, and by a process of elimination, which includes an enquiry into the depths of the shafts in existence at the time, leaves a strip bounded roughly by the outcrops of the thick Coal and the Brooch for more intense examination. Here an entry in the Parish Registers of Bilston preserved in St. Leonards Church, to which Mr. R. B. Prosser directed attention in THE ENGINEER in November, 1879, is of great significance. It is an entry of the baptism on April 8th, 1725, of "Thomas ye Son of John Hilditch, Managr. of ye Fire-Engine att Tipton (he gives yt his Settlemt. is Bartomly-p'ish, Cheshire)."

The writer of the entry was the Rev. Richard Ames, the popular Vicar of St. Leonard's, Bilston, from 1684 to 1730. Affectionately called "Father of his People," he took a great interest in local affairs, and, with great care, entered in the Registers all kinds of information about people, their occupations, where they worked, where they were born, and where they lived. Many other entries made by him show how carefully they were written, and, for this period, the Bilston Registers are in marked contrast, as regards their detailed records, to Parish Registers in general. The Bilston baptismal entry may be taken as it stands, and it is a fair conclusion that the "Fire-Engine att Tipton" was Newcomen's famous engine of 1712.

Thomas Barney's print furnishes corroborative evidence in support of the conclusion that the engine of 1712 was at Tipton. In the right-hand top corner of the print is an inscription dedicating the print to the "Knights, Citizens, and Burgesses of the County of Stafford." Associated with this inscription is a small drawing of a castle. A detailed examination by means of a hand lens shows that it was intended to represent Dudley Castle as seen from the Tipton side. "The location of the actual view-point," says Dr. Lones, "may be matter for argument, and the artist seems to have brought into view a somewhat greater frontage than he could see from one view-point ; but this does not affect the conclusion that the Castle is viewed from the Tipton side."

Another baptismal entry in the Register of St. Leonard's Church, Bilston, may be associated with the engine at Tipton. The entry, a few parts of which are not easily deciphered, reads as follows :—"1726. Sepr. 8—Shaw, John, Mary, Elizabeth, and Hannah ye four children of Anne Shaw, Widd. whose Husband was kill'd some time since by Mr. Compson's Fire-Engine which he Manag'd or Look'd aftr. He was an Anabaptist and wou'd not suffer his Children to be Baptiz'd. He came from Hedgford."

Mr. Compson's engine may have been Newcomen's engine at Tipton, a change in ownership having taken place between the years 1712 and 1726. No record seems to be available of a second Newcomen engine in the district in 1726, or when the fatal accident occurred, although there were many such engines later. Mr. Henry Davey (Institution of Mechanical Engineers) says that the second large Newcomen engine was erected at Griff, near Nuneaton, in 1715. No further information about Mr. Compson has been found, but the Dudley Parish Registers, at St. Thomas's Church, for the period 1710–48, contain entries relating to the Compsons, and there were Compsons living at Kates Hill, Dudley, in the nineteenth century.

The Goodsway.

In a Journal note published in our issue of October 7th mention was made of "The Goodsway," Regd., an underground railway and automatic conveyor system, which it is proposed to build in London to the designs of the founder, Mr. Cedric Erlund. The Goodsway will undertake the carriage of all kinds of merchandise and goods, including coal and other minerals, which may come into, go out of, or be transferred from one part to another of the metropolitan area, covering about 175 square miles. Provision has also been made to extend the system, if required, outside that area in order to cope with future extensions of the Metropolis. By the courtesy of Mr. C. Erlund and Mr. Cameron-Smith, the secretary of the Goodsway, we are now able to give further particulars of the scheme and to outline its technical features.

Tunnel and Conveyor System.

The Goodsway will be designed to take any railway wagons, including those of 50 tons, that can go through main line tunnels. An auxiliary automatic conveyor system will be used to transfer goods from public and private depôts at street or sub-basement level to the underground system. Most of the goods dealt with in this way will be transported in medium-sized containers accommodating weights up to 5½ tons, but provision will also be made to deal with any desired weights at floor levels. The railway will run through 16ft. inside diameter tunnels enlarged to 25ft. at the stations, which will be built at track level. The conveyor tunnels will be of 6ft. to 9ft. internal diameter at most of the depôts, but at the nine principal railway termini special wagon elevators and gradient tunnels, 16ft. inside diameter, will be built to facilitate the rapid handling of goods, and coal and mineral traffic. All important stations will have a tonnage receiving and despatching capacity equal temporarily to the bulk capacity traffic of the lines passing through them. Both the railway and the conveyor systems are to be operated on the 500-volt third-rail system. The tonnage traffic capacity at the commencement of operations will be 67 to 69 million tons per annum, which, however, it is claimed by the promoters, can be increased by 80 per cent. by raising the power supply pressure from 500 to 600 volts and by the addition of sufficient railway goods wagons. The Goodsway railway wagons will be motor-driven and automatically controlled from a central traffic control station, and will be run in units or in twos and threes together. Long rigid trains will not be run.

The total length of track proposed will be about 80 miles and the railway will serve and connect sixty commercial areas. Fifteen of these will be dock areas, nineteen railway areas, six market areas, ten large store areas, and ten general business areas and residential areas. The provision to be made at the nine main line railway stations has already been referred to. Connections are to be made with 120 wharves with conveyor tunnels working in conjunction with overhead and floor level conveyors, a similar arrangement being made in the case of over 150 private stations in stores, factories, and warehouses, &c. Twenty-two coal storage depôts, each having a storage capacity of 60,000 tons and a loading capacity for lorries of 2500 tons within six hours, are to be provided, having a total storage capacity of 1,320,000 tons. The public depôts, of which there are to be fifty-five, will be worked in conjunction with a service of fast-running motor vans collecting over an average radius of 0·73 mile, but with only an average collecting haul of 0·48 mile and an average delivery radius of 1·04 mile and an average delivery haul of 0·69 mile. At the markets special storage depôts, constructed underground, will be available, the goods being stored in 1200 containers in three tiers housed in an underground building 118ft. by 136ft. by 36ft., every container being available at the market by means of the conveyor tunnel in five to six minutes. In addition to the special facilities at the nine main line railway stations and the coal and mineral depôts, which will be available for other traffic by day, there are to be twenty specialised stations with vertical oval shafts for handling outsize containers 15ft. long, 6ft. 9in. wide, and 7ft. high for furniture, &c., and girders, &c., up to 40ft. in length.

Advantages, Construction, and Operation.

It is estimated that the Goodsway will, if constructed, relieve London of about 60 to 65 per cent. of its present street traffic congestion. Much of the traffic at present dealt with by the streets would never come on to the streets at all, and the balance would, it is stated, only have to be carried one-tenth to one-fifth its present distance. A saving of 80 to 90 per cent. of the commercial traffic using the London streets is reckoned upon, with a 60 to 80 per cent. saving in the time of transit now required.

The total capital required to complete the Goodsway will be about £43,210,000, at the rate of £8,000,000 per year over a period of about five and a-half years. The construction, however, would, it is claimed, relieve London of its heaviest transportation charges to the extent of over £60,000,000 annually. The first section of the Goodsway, including about 40 per cent. of its mileage, connecting wharves, markets, and main line railways, and many large store areas, could be in operation in from two and a-half to three years after beginning construction. The capital cost of this first section will be, it is estimated, about £20,200,000, and it will have an available traffic tonnage of about 35,000,000 to 40,000,000 tons.

It is claimed that the scheme would lower the cost of transportation over the 175 square miles area within 12 miles of Charing Cross from the present railway cost of 13s. 3d. a ton and the present commercial distribution cost of 25s. and over per ton to an inclusive charge of only 5s. a ton for any point within 12 miles of Charing Cross.

SIXTY YEARS AGO.

The early days of the locomotive in America are recalled by an article which appeared in our issue of October 25th, 1872. The information given in that article had been extracted from a history of the Baldwin Locomotive Works, which had recently been published by Baird and Co., the proprietors of the establishment. In 1829 and 1830 steam as a motive power on railways was engaging the close attention of many American engineers. A few locomotives had been imported from England, and one, which proved to be unsuccessful, had been built at the West Point Foundry, New York. The proprietor of the Philadelphia Museum, Mr. Franklin Peale, decided to gratify public interest in the new motive power, and asked Mr. Matthias W. Baldwin to build for him a miniature engine for exhibition at his establishment. With the aid only of imperfect descriptions and sketches of the locomotives which had taken part in the Rainhill trials, Baldwin set to work, and on April 25th, 1831, delivered to his friend a small engine capable of hauling two cars containing seats for four passengers. Crowds of admiring spectators flocked to the museum to see the novel spectacle. The model was so successful that in the same year Baldwin received an order for a locomotive from the Philadephia, Germantown and Norristown Railroad Company for use on a line 6 miles in length, which at that date was being operated by horses. The difficulties to be overcome were immense. Good mechanics were scarce, and suitable tools were difficult to obtain. Baldwin had, in fact, to do much of the work with his own hands, to educate the workmen who assisted him, and to devise tools for carrying out the various processes of manufacture. The engine, christened "Old Ironsides," was, however, eventually completed, and was tried on the road on November 23rd, 1832. On the first trip to Germantown one of the driving wheels slipped on its axle, and moved inwards off the rail. In so doing, it fixed the excentric in such a manner that it would not operate in backward motion. In addition, the boiler pumps developed a valve defect, and failed to deliver water. These troubles were duly corrected, and the engine was placed in service making daily runs with passengers who were curious to travel by it. It did duty on the Germantown and other roads for a score of years, but immediately after it was built, the troubles which it had caused him led Baldwin to remark to a friend that it was the last locomotive which he would build. He was, however, too fascinated by the subject to enable him to keep away from it. Gathering fresh ideas from an engine supplied by Robert Stephenson and Co. to the Mohawk and Hudson Railroad, Baldwin undertook to build a locomotive for the Charleston and Hamburgh Railroad Company. This engine, the "M. W. Baldwin," was completed on February 18th, 1834. A similar engine, the "Lancaster," was supplied in June of the same year to the Philadelphia and Columbia State Railroad, and two others in September and November. The Philadelphia and Trenton Railroad was also supplied with a Baldwin locomotive. This engine between October 21st, 1834, and September 15th, 1840, averaged 21,000 miles per year. These five engines of 1834 established a design which Baldwin adhered to for some years afterwards. They embodied several novel ideas, including the "half-crank" axle, wheels cast with the spokes free of each other at their outer ends, ground joints for the steam pipes, and a new form of boiler pump.

A small poster has been issued by H.M. Stationery Office, suitable for display in garages, pointing out the danger of attempting to repair drums or tanks, which have contained inflammable liquid, with blow-lamps, torches, or soldering irons unless it is certain that all trace of the vapour has been removed. Instructions for thoroughly cleansing drums or tanks before being repaired are given on the poster, which is the sequel to an official memorandum on the subject issued last May.

Precision Grinding Machines.

No. V.*

CYLINDRICAL GRINDING—INTERNAL (*continued*).

An American Example.

The machine illustrated by the engraving—Fig. 25—is of American design and is made by the Landis Tool Company, for which Burton, Griffiths, Ltd., of Birmingham, are agents in this country. It is rather larger than either of the two machines just described, being capable of accommodating work up to 15in. external diameter and grinding bores up to 8in. long, and is of particular interest in that when grinding holes no deeper than 2½in., it is not necessary to traverse the work, the wheel head itself being reciprocated hydraulically by means of a cylinder and piston arrangement, the control valve for which can be seen at the extreme right-hand side. The reversing valve is actuated by adjustable stops mounted on the slide, and the traverse speed can be adjusted to anything between 6in. and 180in. per minute.

In many respects the details of the machine follow ordinary practice. It is of semi-automatic type operated by a pedal, which causes the work carriage to move over to the grinding position. The work rotation and the reciprocation of the grinding wheel both start automatically at the proper time in the cycle. A second depression of the pedal when the work has been ground to size causes the work carriage to return to its original position, while the work rotation and grinding wheel reciprocation cease. The pedal is not used when holes larger than 2½in. are to be ground. The Landis Tool Company is at the time of writing making improvements to its many productions, so that a detailed description of the machine might well be out of date by the time of publication.

Planetary Grinders.

For irregularly shaped work, particularly of large size, internal grinders of the types described are not very suitable owing to the difficulty of mounting and swinging such work. Cylindrical work, even of the largest size, as witness the large Holroyd internal grinding machine, can be mounted and rotated without difficulty, but for such parts as cylinder blocks the design of a rotating work head would be a matter of great difficulty. These facts have resulted in the development of a type of internal grinding machine in which the work can be mounted rigidly and immovably on a table while the equivalent of rotation is provided by giving the grinding wheel itself a planetary motion. The feed is then obtained by increasing the radius of the planetary motion of the wheel, while the length of the bore is covered either by a reciprocating motion of the work, which can be imparted to it with some ease once the rotating motion is dispensed with, or by traversing the whole carriage upon which the grinding wheel is mounted, thus centring every motion upon the wheel head itself. By so arranging the machine one difficulty is only substituted for another, for the grinding wheel has now not only to rotate, but it must also travel in a planetary path and feed at the same time. The complexity of such a motion is, however, preferable to attempting to design a work head capable of accommodating all types of irregularly shaped castings and forgings.

A Duplex Machine.

The machine illustrated by the tone engravings—Fig. 24—is of the "planetary" type, and is constructed by the Churchill Machine Tool Company, Ltd. It will be seen that it is double-headed. It was originally designed for grinding the double cylinders of Westinghouse air pumps, its construction permitting the simultaneous grinding of two bores which are in axial alignment, but which, owing to the construction, cannot be ground straight through with a long spindle. The two grinding heads are exactly similar, but of opposite hand. Each is mounted upon a wide carriage on a long bed. The carriages are traversed automatically by two hydraulic mechanisms of a type already described, the controls for which can be seen mounted on the bed below each carriage. The bridge piece, which carries the work, is mounted at the centre of the bed and is capable of vertical and transverse adjustment, either automatic or by hand, and the various drives, which are of the usual Churchill type, can be seen from the engraving showing the back of the machine. The traverse of the work table is operated by a separate motor, whilst the two pumps for the hydraulic mechanisms, the coolant pump, and the dust extractors are all driven by one 5 H.P. motor. Motors of similar power operate the planetary motion, and the grinding wheel spindle of each of the grinding heads. These motors are mounted at the tops of their respective heads.

Perhaps the most interesting point in the machine is the design of the wheel head drives and the arrangement by which the feed can be applied by a stationary hand wheel while the machine is running. Reproduced in Fig. 26 there is a sectional assembly drawing of the wheel head showing how the planetary motion is given to the grinding wheel, and the details of the feed mechanism. The grinding wheel is mounted at the end of a spindle extension piece which may be of several different designs, according to the work for which it is fitted. One such piece is shown in another drawing—Fig. 27. This spindle extension piece bolts excentrically on to the face of a grinding spindle sleeve which, with the rest of the planetary and feed mechanism, is enclosed in a housing on the grinding head. The spindle sleeve has an excentric bore through which the grinding spindle passes, supported on ball bearings, to carry at its further end a pulley for the belt drive of the rotary motion, and is itself carried within the excentric bore of the main grinding head spindle. The distance between the axes of the main spindle and the spindle sleeve and the distance between the axes of the spindle sleeve and the grinding spindle are equal. Thus, in effect, the grinding wheel is mounted excentrically upon an excentric and the two excentricities are equal. It follows that by rotating the spindle sleeve through 180 deg. the grinding spindle can be made coaxial with the main spindle, or, alternatively, excentric with it by an amount equal to the two excentricities added together. In the latter, or any intermediate position, the grinding wheel will trace out the desired planetary path when the main spindle revolves, providing that the spindle sleeve revolves as one with it. The drive to the main spindle is taken from a pulley mounted on the head immediately above that providing the rotary motion of the grinding wheel. The shaft on which this pulley is mounted passes right across the box to the front, where it carries a small spur gear wheel A. About half-way between the spur gear wheel and the pulley the shaft passes through a differential box B, in which it drives an arrangement of spur gearing. In its turn this gearing drives a sleeve C encircling the

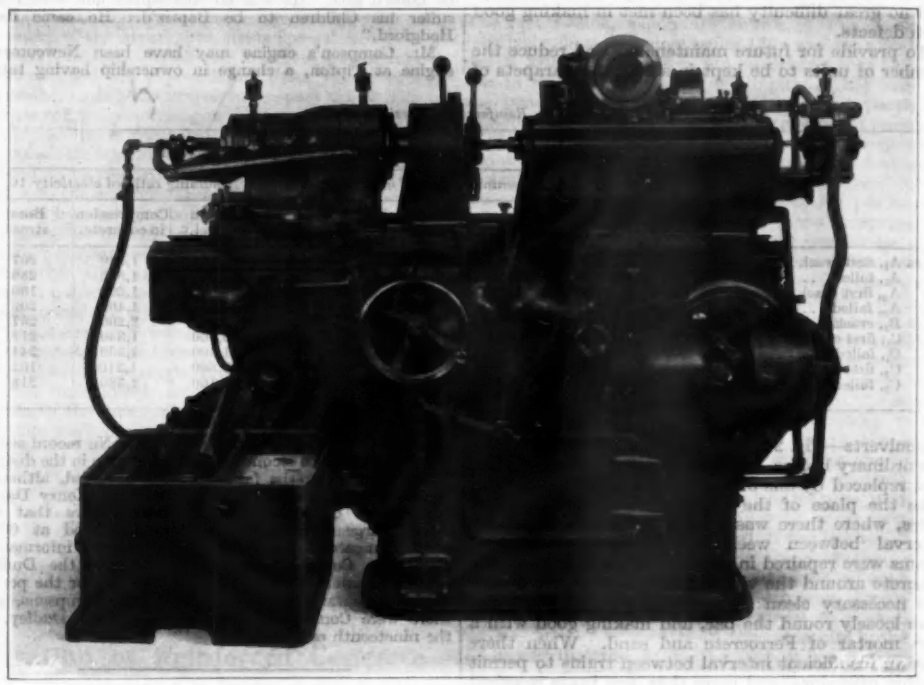


Fig. 25—Landis Semi-Automatic Internal Grinder

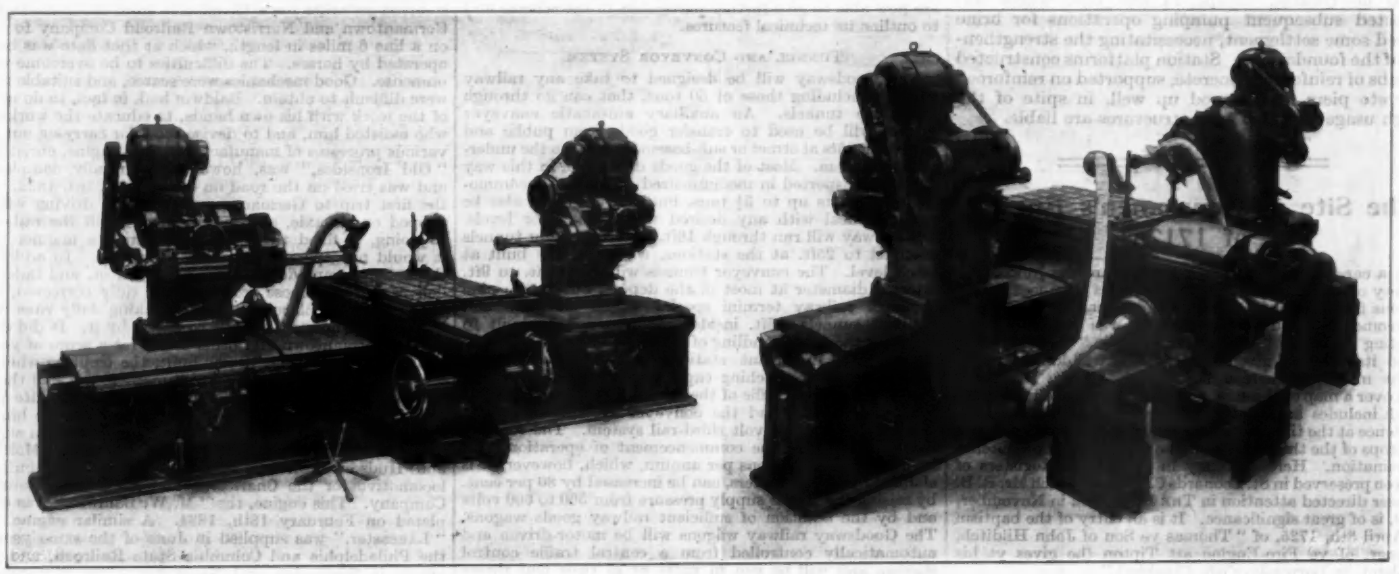


Fig. 24—Front and Rear Views of Churchill Duplex Planetary Internal Grinder

* No. IV. appeared October 14th.

WHEELHEAD OF CHURCHILL PLANETARY INTERNAL GRINDING MACHINE

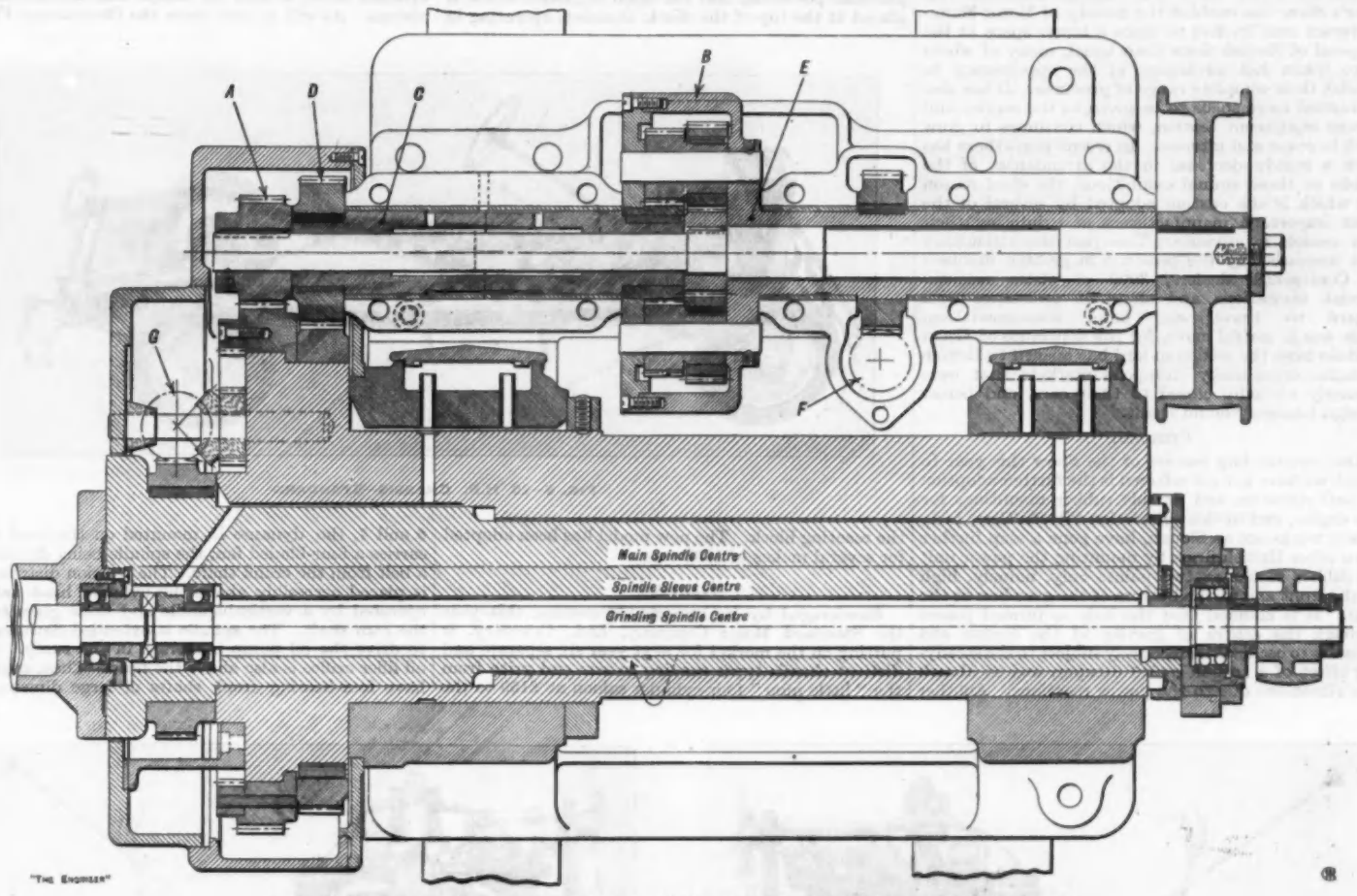


FIG. 26—SECTIONAL VIEW OF WHEELHEAD SHOWING CONTROL OF PLANETARY POSITION

shaft, and this sleeve carries at its other end a small spur gear wheel D mounted alongside the similar wheel A. The wheel D is larger than the wheel A and it drives the main spindle directly. The other wheel A is responsible, as will be explained shortly, for controlling the planetary radius of the grinding wheel. The gearing of the differential is so calculated that while the differential as a whole remains stationary the relative speeds of wheels A and D are such that, if they both geared appropriately with it, they would drive the main spindle at the same speed. The differential box is so mounted on a sleeve E over the driving shaft, however, that it can be rotated by means of an external hand wheel operating a worm and wheel at F. Rotation of the differential as a whole causes the relative speeds of the wheels A and D to alter. The wheel A drives a ring mounted on the end of the main spindle and this ring carries an overhanging set of internal gear teeth which engage with a spur gear mounted on the exposed face of the main spindle. By an arrangement of bevels this spur gear drives a worm G, the wheel for which is mounted upon the grinding spindle sleeve. Thus, when the differential is rotated the relative speeds of the wheels A and B are thrown out of adjustment, with the result that the ring is moved relatively to the main spindle. Thus, the spindle sleeve is rotated within the main spindle by the arrangement of bevels and worm gear G, and the "planetary" setting of the grinding wheel is altered. When the differential is not in motion the relative positions of the main spindle and the spindle sleeve are maintained by the locking action of the worm. Similarly, unless the hand wheel is rotated the differential is locked in position by its worm drive. The pulley by means of which the rotary motion is given to the grinding wheel follows, of course, the planetary motion of the wheel. Consequently, means have to be provided for maintaining the tension of the driving belt. This device is best seen by reference to the tone engravings. The driving motor mounted on the top of the grinding head drives by means of a belt a countershaft mounted upon a swinging arm pivoted around a point on a level with the base of the motor. This countershaft is, therefore, able to swing through a small arc without appreciably affecting the tension of the driving belt. From a second pulley on the countershaft a second belt drives the grinding spindle, the distance between the countershaft and the grinding spindle being maintained constant by an adjustable steel linking piece. The makers state that they have used the patented feed mechanism just described on machines of their manufacture for about twenty years, and have found it very satisfactory and reliable.

One of the matters to which makers of "planetary" type grinding machines must pay special attention is the need for easy setting up of the work coaxial with the main spindle. The line engraving Fig. 28 illustrates the operation on a machine such as that just described. A gauge or trammels is set at the end of the grinding spindle. The plunger A on the face plate of the machine is withdrawn. This plunger connects the plate itself through the feed worm gear G—see Fig. 26—to the main spindle. The exposed face of the spindle sleeve may now be rotated freely by the use of a turning bar in hole B until a mark upon it comes opposite to an index line on the face plate indicating zero excentricity. The plunger A is then released and the feed handle C turned until it falls into place. It should be noticed that the face plate carries an index showing the excentricity of the grinding spindle in inches. When the setting has been made the work may be moved into position by the use of the vertical and transverse motions of the work table.

(To be continued.)

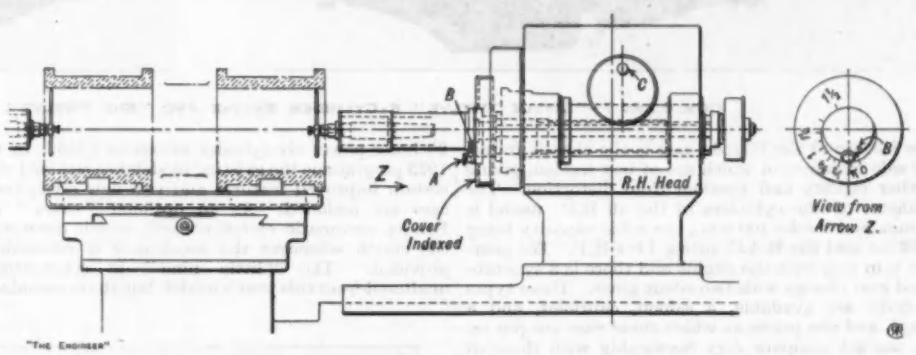


FIG. 28—SETTING UP WORK COAXIAL WITH MAIN GRINDING SPINDLES

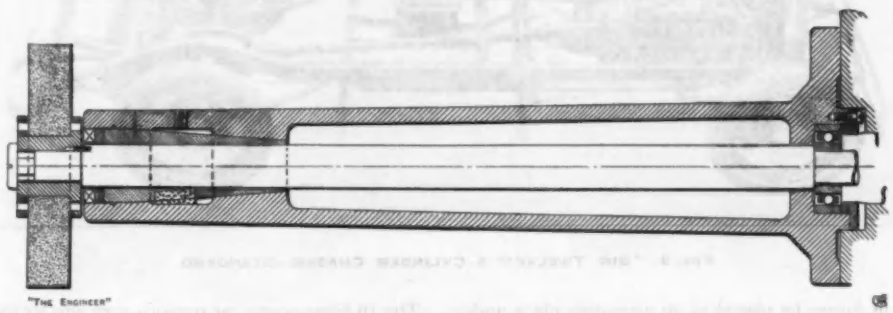


FIG. 27—SPINDLE EXTENSION PIECE

THE retirement, recently noted in the *Southern Railway Magazine*, of Mr. R. E. J. Morton, of the Ashford Works, prompts us to remark that his father was at the Newton Heath Works of the Lancashire and Yorkshire Railway and was the inventor of Morton's wagon brake. By its means the brake lever on either side of a wagon would apply the brake to all four wheels and "Morton's brake" later became a standard requirement in the Railway Clearing House specifications for privately owned wagons.

The Motor Car Show at Olympia.

No. II.*

The absence of some of the foreign makers at this year's Show has enabled the Society of Motor Manufacturers and Traders to place a larger space at the disposal of British firms than usual, many of whom have taken full advantage of the opportunity to exhibit their complete range of products. It has also permitted more space to be given to the service and garage equipment section, which continues to grow both in scope and interest. In recent years there has been a steady decrease in the attendances of the public at these annual exhibitions, the chief reason for which is the custom adopted by several of the most important manufacturers of exhibiting their new models in advance. This year the attendance was increased by the presence in greater numbers of Continental dealers, 3000 of whom received special invitations and offers of assistance with regard to travel and hotel accommodation. This was a tactful move, for the departure of Great Britain from the gold standard has opened to British manufacturers many European markets that were formerly virtually closed to their cars, and better foreign business should result.

Citroen.

One outstanding feature of the Show this year to which we have not yet referred is the further adoption of anti-vibration and flexible rubber mountings for the engine, and in this connection Citroën Cars, Ltd., whose works are at Slough, have gone a step further than other British firms by mounting the power unit on rubber blocks at two points only, namely, high at the front and at the bottom of the gear-box at the rear. It is claimed that the axis so formed passes through the centre of gravity of the engine and allows it to oscillate transversely subject to the steadying effect of a torque spring damper, and to absorb the vibrations due to the power reactions. Another new feature of the Citroën cars is the chassis frame, the side members of which are of box section, giving further rigidity and freedom from distortion. The diameter of the cylinders of the 10 H.P. model is 68 mm. and stroke 100 mm., the cubic capacity being 1452 c.c. and the R.A.C. rating 11·4 H.P. The gear-box is in unit with the engine and there is a synchronised gear change with two silent gears. Three types of body are available, a saloon, cabriolet, and a coupé, and the prices at which these cars are put on the market compare very favourably with those of other builders. Two other cars, a 12 H.P. and 20 H.P. car, are made by the Citroën firm, and the same method of engine suspension is adopted as in the 10 H.P. cars.

Lucas.

One of the most widely adopted shock absorbers on British cars is the "Luvax," which works on the hydraulic principle, with oil as the liquid. It has been noted that hydraulically assisted suspension systems are usually harsher at the commencement of a run—and particularly in cold weather—than they are when the car has been on the road some time. This is due to the difference in the viscosity of the oil used in the shock absorbers. When cold this is comparatively stiff and it does not flow freely past the regulating valve. The constant oscillation of the rotor, however, in the operating chamber produces an increase in temperature of the fluid and alters the viscosity so that the oil flows more freely. To overcome this, Joseph Lucas, Ltd., have introduced an ingenious refinement into their shock absorber in the shape of a small thermostatically controlled valve which reacts to the variations of temperature of the oil. The valve is housed in the rotor spindle and opens or closes a duct drilled in the rotor, giving a freer flow of oil when it is thick and a more restricted flow when it is thin, thus giving a more constant damping effect at all temperatures. The general arrangement of the Luvax shock absorber remains otherwise unchanged. The base and working chamber are in one piece, the outer chamber being pressed into position. The space between the inner and outer chambers acts as a recuperator and contains a reserve supply of oil, which is automatically drawn upon as that in the main chamber is used up. An air release prevents pocketing and the main regulator screw is placed at the top of the shock absorber, operating in the reacting block. The new model has been adopted for several makes of 1933 cars.

* No. I. appeared October 14th.

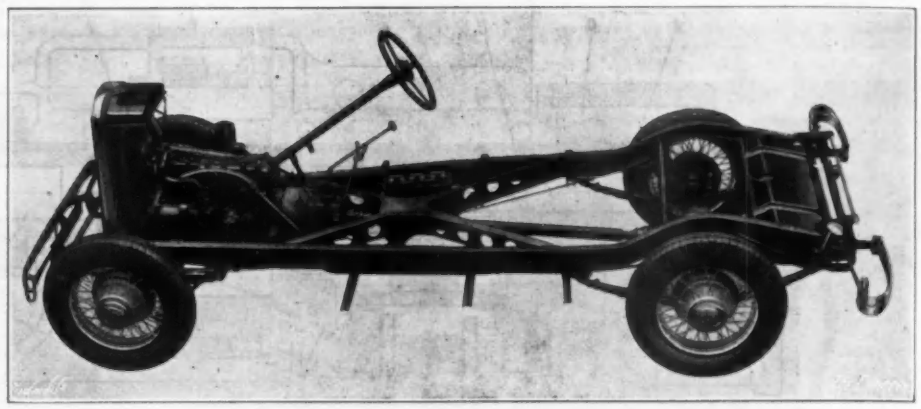
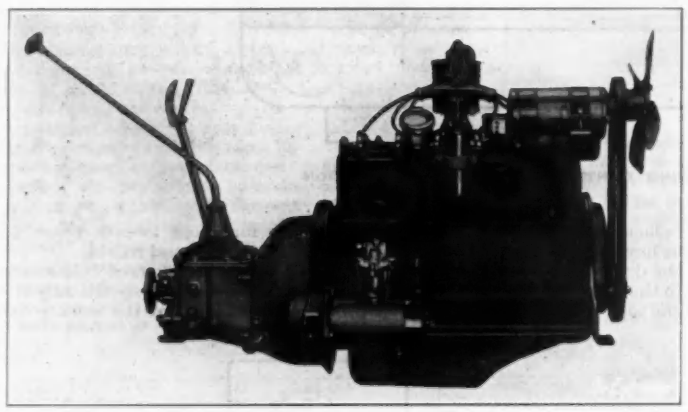
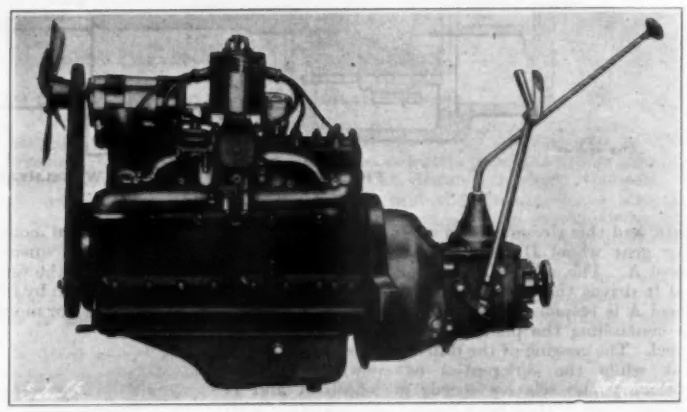


Fig. 8—20 H.P. Chassis—Standard

Standard.

Encouraged by its remarkable success, this year the Standard Motor Company, Ltd., Coventry, is putting on the market for next year six separate and distinct chassis types ranging in size and price from the "little nine" four-cylinder saloon at £159 to the 20 horse-power six-cylinder saloon at £355. In the 1933 programme the existing models are retained with certain improved features and two new six-cylinder cars are included. As an optional "extra" the Bendix automatic clutch control, which disengages the clutch whenever the accelerator is released, is provided. The "little nine" is substantially unaltered from this year's model, but the accumulator will in future be placed in an accessible place under the bonnet and a breather pipe is taken from the engine oil filler downwards to discharge the oil vapours away from the body of the car. Similar steps have been taken in connection with the "little twelve" six-cylinder car. The new models—the "little twelve" six-cylinder and "big twelve" six-cylinder cars—Figs. 6, 7 and 9—are on similar lines, but whereas one is rated at 12 horse-power, the other is rated at 14 horse-power, the cubic capacities being 1337 c.c. and 1497 c.c. respectively. Both of these engines have side-by-side valves, operated by mushroom tappets and harmonic cams, a detachable cylinder head, a steel oil sump, and aerolite alloy pistons. As will be seen from the illustrations Figs. 6 and 7, the dynamo is mounted on the head and carries a four-bladed fan, the spindle being driven by a belt from the crank shaft. The ignition distributor is placed accessibly above the cylinder head and is operated by a vertical-spindle and skew gears from the cam shaft. The spindle is extended downwards to drive the oil pump immersed in the sump. The oil filler orifice is also above the head. These engines have four-bearing crank shafts of large dimensions and the lubricating oil is carried upwards under pressure through pipes clipped to the connecting-rods. The inlet and exhaust manifolds are bolted to the near side of the cylinder block and the latter discharges the exhaust gases to a pipe at the forward end. Solex carburetters are fitted and feed the mixture horizontally into the centre of the inlet pipe on to a hot spot.





Figs. 6 and 7—"Little Twelve" 6-Cylinder Engine and "Big Twelve" 6-Cylinder Engine—Standard

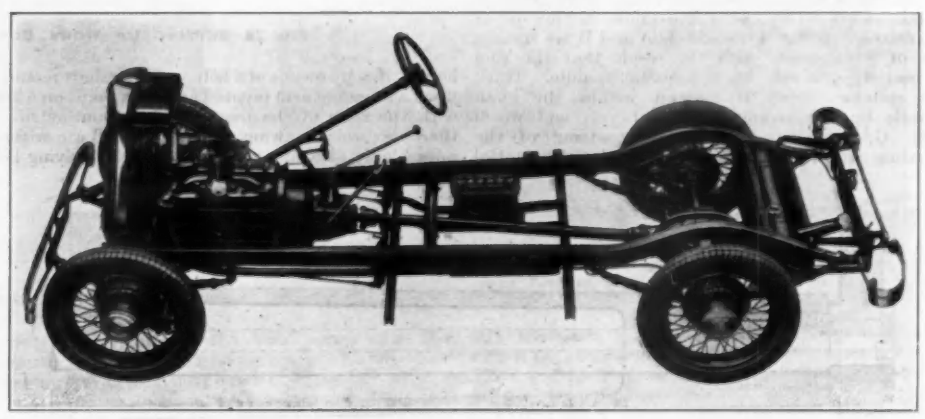


Fig. 9—"Big Twelve" 6-Cylinder Chassis—Standard

The 16 horse-power car remains very similar to the present one, except that thermostatically controlled radiator shutters, improved springing and grouped chassis lubrication are being introduced, together with improved body work. As regards the 20 horse-power car, the chief changes are a new clutch called the Borg and Berg, and a new and stiffer chassis frame braced together by a central cruciform structure. This is hollow in the centre to enable the

propeller shaft to be carried through. The forward extremities of the X-shaped bracing are close to the rear mountings of the engine and the after ends connect up with the side frames close to the anchorage of the front ends of the rear springs. The chassis designed cover, totally enclosing the rear of the chassis. The spare wheel is carried at the rear of the body. The interior of the car is fitted with two detachable bucket seats at the front, with pneumatic cushions. The rear seat and squab are of full width with six cylinders of 2023 c.c. capacity and the rating is 15·72 horse-power. Lubrication is by pressure from a gear type pump forcing oil to all bearings, big ends, and to the overhead valve mechanism. Ignition is by coil and battery. The clutch of the single-plate type

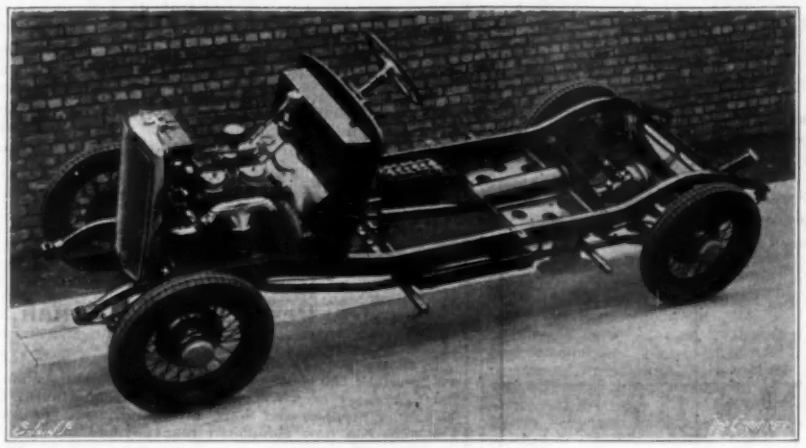


FIG. 10—10 H.P. CHASSIS—CROSSLEY

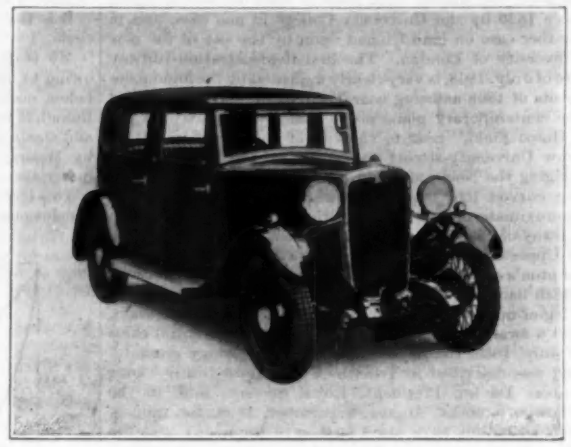


FIG. 11—"BUXTON" SALOON—CROSSLEY

construction is clearly shown in Fig. 8. The body work in all the Standard models has been further improved, the saloons are of the four-door six-window type with ample headroom and seating accommodation. Four speed gear-boxes with a silent third gear are used on all models.

CROSSLEY.

In conformity with the practice of the leading makers, Crossley Motors, Ltd., Manchester, are showing several models varying from 10 to 20·9 horse-power. The small 10 H.P. car, which has already earned a high reputation, has a four-cylinder engine, with cylinders 62·3 mm. bore and 90 mm. stroke, with a cylinder capacity of 1097 c.c., and is rated at 9·6 horse-power. It has aluminium pistons and the cylinder head incorporates a special combustion head formation with two overhead inlet valves per cylinder, operated by push rods and rocking levers. The exhaust valves are on one side, with the sparking plugs above them. The valve covers are readily removed, and the tappet adjustment easily accessible. The induction pipe is part of the cylinder head. Twin chain drive, easily adjusted, is provided to the dynamo, and lubrication of the engine is by an oil pump driven by spiral gears from the cam shaft. The lubricant is under pressure to all the main bearings, as well as to the big end bearings, while automatic lubrication is provided for the overhead valve spindles and rocker levers and bearings. Two carburetters are fitted, one at the front and one at the rear of the cylinder head. Coil ignition, controlled by a lever operated from the steering column, single plate clutch, and a four-speed gear-box with a twin top silent third, are part of the chassis equipment. Another feature of interest is an electric petrol lift from a tank at the rear controlled in series with the ignition switch. A view of the 10 H.P. chassis is given in Fig. 10, while Fig. 11 shows the neat Buxton 10 H.P. saloon fitted with six windows. The four doors are each fitted with drop windows, are complete with outside and inside door handles, and there is a locking device inside three doors. A private door lock is incorporated in the handle on one pneumatic cushion. The rear seat is built with fixed arm rests, thus giving a comfortable sitting position for the rear passengers.

ROVER.

Numerous new features are embodied in the new Rover products, which include 10, 14, 16, and 20 horse-power cars. The 10 H.P. car has a four-cylinder engine with a capacity of 1185 c.c., overhead valves, coil and battery ignition, four-speed gear-box, and Lucas "Startix" automatic engine starter. The 14 H.P. "Pilot" car has six cylinders with a capacity of 1577 c.c., overhead valves, coil and battery is automatically controlled on the Bendix system by the accelerator pedal and independently operated by another pedal. The gear-box has four speeds, including a silent third speed and the brakes are of the Bendix-Perrot type. A "Startix" automatic starter is fitted on the engine and a free-wheel device is provided in the transmission system. Views of the 14 H.P. "Pilot" coach-built saloon and chassis are shown in Figs. 12 and 13.

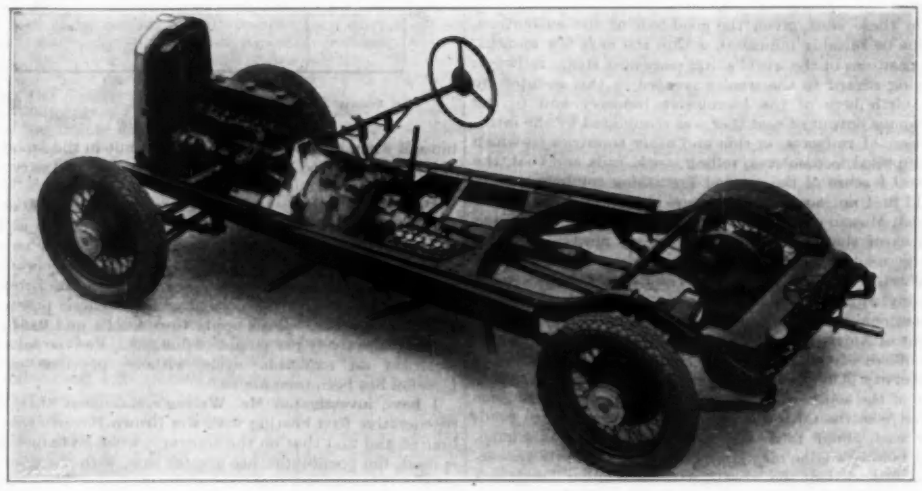


FIG. 13—14 H.P. "PILOT" CHASSIS—ROVER

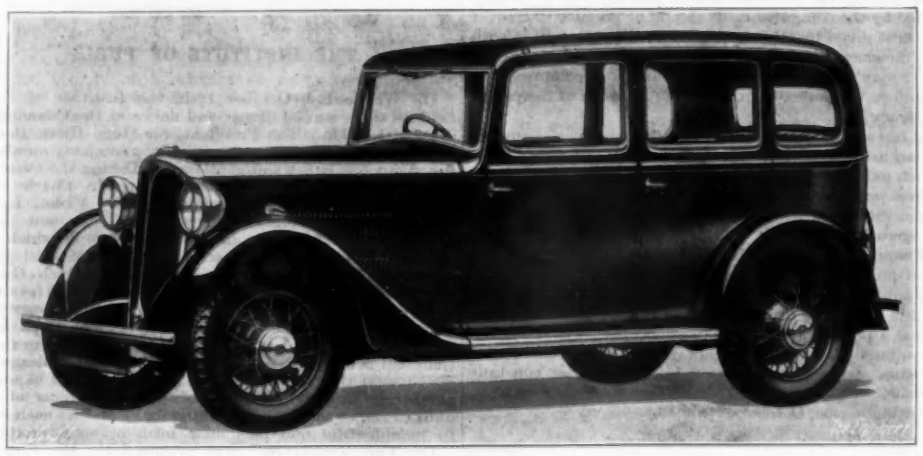


FIG. 12—14 H.P. "PILOT" SALOON—ROVER

front door. The wings are streamlined and conform to the general lines of the body. The front "apron" is arranged to be easily detachable from the chassis. The rear petrol tank is shielded by a specially ignition, four-speed gear-box incorporating a free-wheel device, and Lockheed hydraulic brakes all round. The engine is carried on silent flexible mountings. The "Meteor" 16 horse-power car has

(To be continued.)

Letters to the Editor.

(We do not hold ourselves responsible for the opinions of our correspondents.)

THE TREVITHICK CENTENARY—1833–1933.

SIR,—In connection with the meeting of engineering societies which took place yesterday, October 20th, at the Institution of Civil Engineers, in order to discuss the means to commemorate the Trevithick centenary, will you permit me to suggest that the event will most likely lead to discoveries at present completely unknown to most engineers and certainly not known to many who now study the history of engineering technology? Trevithick was the originator of steam railways, the inventor and patentee of the container system of transport (as recently taken up by the railways), and the first man to propose, or actually to run, a road coach on a railway without any change of its wheels or of its tires, and this plan will, I think, eventually, as there are now indications to show, conciliate the interests of road and rail transport companies, by simple mechanical means, more effectively than a dozen "Salter" or such-like reports, by enabling the rail companies to run the present pneumatic-tired road traffic on the railways far more economically than road companies can at present run it on the public roads with petrol or oil motors.

I desire to suggest that there are many who are not engineers and, at the present moment, actually indifferent to all railways, who may never otherwise know of the intended commemorations, yet whose interest in the forth-

coming centenary should be engaged without any loss of time if it is intended to make this a great national event, centred in the heart of London and near to the British Museum. For, according to the extensive publicity campaign undertaken to promote steam passenger railways in 1808 by the influential and titled friends of Trevithick, the first public exhibitions of passenger travel on steam railways ever known took place in 1808 on land occupied since 1826 by the University College in one case, and in another case on land fringed upon by the site of the new University of London. The first demonstration railway site of July, 1808, is very clearly indicated by the announcements of 1808 as being near Tottenham Court-road; and the contemporary plans prove that it was partly on the "Home Field," near to the end of Ducking Pond-street (now University-street) and partly on the "Cow Liers" fringing the New-road, and that the eastern periphery of the curved line was on the "Spring Field." On the approximate centre of the world's first passenger steam railway of 1808 now stands the present University College, in Upper Gower-street. This railway was on Lady Southampton's estate and was laid on ground with sand subsoils which had been but a few years previously occupied by a "leg-of-mutton" pond, by a stream in a deep depression, and a swampy "spring field." After the torrential rains of July, 1808, the railway sank in the "spongy ground," and was described in Trevithick's letter to Giddy—later Gilbert Davies, President, Royal Society—and, in the following months, August, September, 1808, the railway demonstrations took place farther to the south, and the site was then indicated to intending visitors as the "field near Russell-square," where the engine was announced to run endurance tests during twenty-four hours in covering "at least 240 miles in the limit named." The new site for demonstrating to potential company promoters the practicability of passenger travel on steam railways was known on the maps as the Long Field, formerly Southampton Field, generally a part of Lamb's Conduit Fields, but on a portion popularly called the "Field of the Forty Footsteps," lying between Woburn-place and what was later on Tavistock-street and ultimately Tavistock-square; that is, the continuation of the new "British Museum-avenue" on which the new London University is being erected.

On these sites, given the good-will of the authorities, might be suitably indicated, within the next few months, the positions of the world's first passenger steam railways. Having regard to the wealth created in this country by the birth here of the locomotive industry and to the enormous output of coal that was stimulated by the introduction of railways, in this and other countries to which we supplied locomotives, rolling stock, rails and coal, the central feature of the coming Trevithick commemoration could find no more suitable focus than here, near to the British Museum, in which institution the original printed notices of the great event of 1808 are always open for public reading. From aerial photoviews taken of this southern site it seems that there could be no nobler setting for any railway memorial, right in the heart of modern educational and beneficent institutions, and the customary haunt of American visitors to this country. Significantly, the offices of the Institute of Historical Research of the University of London actually stand on ground that was part of the southern railway site of September, 1808, not so far from the Cotton Factory in Tottenham Court-road, that was, about 1806, operated by a Trevithick engine. This factory engine may have been identical in its appearance, but without the wheels, with the regular Trevithick "locomobile" type of steam engine as applied by him to factories, barges, dredgers, excavations' pumping plants, farm and to agricultural tractors and threshers, and also to steam railways.

The houses which formed the background to the 1808 railways on Woburn-place (south of Tavistock-square) and on the New-road (north side of the present Euston-road) are rapidly being removed in favour of the modern horrors in architecture, so that if records are to be preserved of these 1808 backgrounds no delay should occur in making photographs of them. Needless to say, the belated conception of this event in a fantastic picture attributed to "Rowlandson" is fictitious, and completely absurd, for it represents buildings that were only erected after 1826; while the engine as depicted in it bears certain marks of "1846" locomotives. The marvel is that the Science Museum should give space to a spurious production that is intended to represent Euston-square as the site where no such railway was ever seen; and the "artist" who drew that picture never troubled himself to look at the 1808 maps to see that, where he showed a town, it was in 1808 clear open country for miles away to the north of it.

The "Orange Tree" inn, on the New-road, near to the "Cow Liers," and where tickets of entrance were sold at 5s. each (about 15s. in present currency), still exists but in name only, although the present adjacent houses on the east side of the inn actually overlooked the hoardings that were erected around the July, 1808, railway.

CHARLES R. KING.

3, Dartmouth Park-road, N.W.5.

[Considerable differences of opinion concerning the site of Trevithick's London railway exist, and Mr. King's views should be accepted with caution. So far they have not been generally accepted by historians.—ED. THE E.]

OVER 100 PER CENT. EFFICIENCY.

SIR,—In an attempt to be brief in my interpretation of the Brown-Boveri explosion cycle I described the effect on the steam part of the cycle in a single statement which was, as Mr. Waring states, misleading. This point will be explained by the following diagram, in which the quantity of heat available per pound of flue gas is plotted against the temperature at and above which it is available.

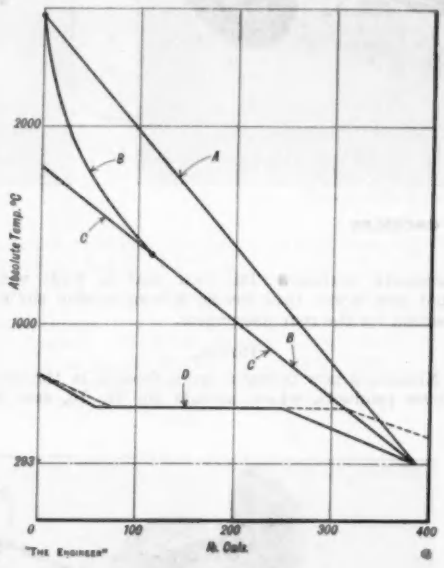
C is the cooling curve for the normal boiler.

A is the cooling curve obtainable by cooling after explosion at constant volume, in which case no energy could be obtained from the turbine. This is the cycle which "M.I. Mech. E." mistook for the Brown-Boveri explosion cycle.

B is the cooling curve for the Brown-Boveri explosion cycle.

My statement that the possible efficiency is reduced owing to lower mean temperatures meant that curve B is below curve A. My statement unfortunately read as though it were also below curve C, but this is not the case, and steam efficiencies as high as normal could be obtained by Messrs. Brown, Boveri, being only limited by boiler materials.

This is what Mr. Waring means when he states that my conclusions are misleading, but he makes the same error



himself when he states that there is a limit in the amount of regenerative feed heating, this being only true if curve B is compared with curve A.

Supposing steam to be produced at 800 lb. and 450 deg. Cent., the heating curve for the steam side is given at D. If regenerative feed heating is used, the dotted curve applies and 26 per cent. more steam may be generated, the quantity being, however, the same with the Brown-Boveri cycle as with the normal or atmospheric pressure cycle. The steam curves apply to 0·485 lb. and 0·61 lb. steam respectively per pound of flue gas. For the sake of clearness an explosion cycle without previous compression has been used above.

I have investigated Mr. Waring's statement that the regenerative feed heating with the Brown-Boveri cycle is limited and find that on the contrary, when a compressor is used, the possibilities are greater than with the normal cycle. It is assumed that part of the feed goes through the economiser and part through the regenerative heater. With the normal cycle 59 per cent. may be regeneratively heated and with the Brown-Boveri cycle, using compression to 2 atmospheres, 62 per cent. may be regeneratively heated. This does not indicate to me a limitation of the possibilities of regnerative feed heating.

I wish to correct my previous statement (*c*) "the surplus energy from the turbine blower shaft . . . is the same as before" to "is increased," the energies being in the two cases respectively 2·7 per cent. and 4·5 per cent. of the calorific value of the fuel. This is due to the fact that the turbine recovers only 52 per cent. of the energy added by the compressor. It should be possible to recover the heat given by the compressor to the steam cycle with an efficiency of 48 per cent.; actually only about 30 per cent. may be recovered and the use of a compressor is therefore theoretically unsound, as a means of increasing efficiency.

It has again been suggested that there is a heat-pumping action in these cycles. How anyone can describe a cycle which exhausts gases at temperatures below atmospheric as heat pumping beats me. This is obviously a refrigerating cycle, the steam boiler corresponding to the gas cooler of refrigerating plants.

I cannot agree with Mr. Hinton's remarks on the constant-pressure cycle. It is theoretically impossible for the apparent boiler efficiency to be over 100 per cent. and for the turbine to drive the compressor at the same time; this is a peculiarity of the explosion cycle, which has the advantage of a much higher initial temperature and pressure owing to combustion taking place at constant volume.

R. W. CORBITT.

Sittingbourne, October 17th.

SIR,—Allow me to point out the error in Mr. Waring's P.V. diagram in your issue of September 2nd *re* the Brown-Boveri steam generator. The volume of the gases at p_3 is the volume of the combustion chamber. How can this be less at p_2, especially as the volume of the gases is then the volume of the combustion chamber plus the volume of the gas space between valves B and C? Mr. Waring has shown the volume at p_3 to be nearly half the volume of the combustion chamber. Can he tell us what is filling the other half?

W. T. BOTTOMLEY.

Newcastle-on-Tyne, October 17th.

LEICESTER AND SWANNINGTON RAILWAY.

SIR,—There is no longer any doubt that the picture by Ferneley, illustrated in THE ENGINEER for August 12th last, represents the opening of the Leicester and Swannington Railway, on July 17th, 1832. A member of the staff of the Leicester Public Library, who has compared the ground as it now is with a photograph of the picture, reports that he is of opinion that "the place is Bagworth Station, the Leicester side of the tunnel. A great many trees have grown up since then."

C. F. DENDY MARSHALL.

Guildford, October 5th.

Service Results of s.s. Annan.

IN an article which appeared in our issue of August 19th, we described the converted engines of the s.s. "Annan," the machinery of which was recently reconditioned by Alexander Stephen and Sons, Ltd., Linthouse, Glasgow. The ship has now completed four voyages on service, and the fuel economy expected has been fully realised. The average fuel consumption per voyage taken over the six summer months, from April to September, of the two years previous to reconditioning was 92 tons, which figure included all coal used in port for raising steam, working winches and for banked fires estimated at about 11 tons.

The corresponding figures for the four voyages now completed are: First voyage, 62 tons; second voyage, 54 tons; third voyage, 50 tons; fourth voyage, 51 tons, the average consumption for four voyages being 54·25 tons.

The difference in these results of, say, 38 tons, represents a saving of 41·3 per cent. on the total fuel per voyage, including coal used in port. It may be pointed out that if the coal used in port, estimated at 11 tons, be deducted from the coal consumption in each case, the improvement in the coal consumption at sea is increased to 47 per cent.

The average displacement during the four voyages in question was about 1837 tons, compared with an average of 1931 tons over the two previous years. About 45 tons of this reduced displacement was due to the lighter machinery. The speed in service remains the same as before the machinery was reconditioned, and the saving of coal has resulted from the various modifications made to the machinery installation.

The following figures taken between Belfast and Glasgow on the first voyage will give an indication of the results obtained:—

Mean r.p.m.	78·5
H.P. receiver pressure	192 lb. per sq. inch
Superheat at stop valve	83 deg. Fah.
Vacuum	28·7in.
Hotwell temperature	104 deg. Fah.
Average I.H.P.	805
Pounds of water per I.H.P.	13·2 for all purposes
Temperature of air entering furnace	208 deg. Fah.
Temperature of flue gases below air heater	435 deg. Fah.
Temperature of flue gases above air heater	335 deg. Fah.
Temperature of feed water	208 deg. Fah.
Boiler efficiency	77 per cent.
CO_2 percentage	11 per cent.

Owing to the varying revolutions during the voyage, it is not possible to give any figures for coal per I.H.P., but the figure for feed water, which was taken by an accurately calibrated water meter, gives an indication of the result obtained. With higher superheat, further improvement will be possible, as during trials a superheat of 130 deg. was easily maintained. The figures for loading and coal consumption were supplied by the owners, William Sloan and Co., of Glasgow, and the remaining results were obtained by the technical staff of Alexander Stephen and Son, Ltd., who sailed on the first voyage.

THE INSTITUTE OF FUEL.

ON Wednesday, October 19th, the Institute of Fuel held its sixth annual dinner and dance at the Connaught Rooms, London. The President, Sir Hugo Hirst, Bart., was in the chair and was supported by a company numbering about 530 ladies and gentlemen. During the evening the Melchett medal was presented to Mr. Charles M. Schwab, the presentation being made by Violet, Lady Melchett. Mr. Schwab delivered an eloquent and humorous speech in response, in the course of which he contrasted British and American methods of steel production. While acknowledging the lead which Great Britain had taken in originating all the great steps forward in the metallurgy of steel, he submitted that American manufacturers in the development of these steps had forged ahead with more energy and had taken more risks than had been shown or taken by their British colleagues. He thought that the British steel industry would be more prosperous than it was if it reduced the number of its mills to 20 per cent. of the existing figure and set each mill to manufacture one particular form of steel product. "The Fuel Industries" was proposed by Mr. Charles Mitchell, of Dorman, Long and Co., Ltd., and was responded to by the President. Mr. George Usher, of International Combustion, Ltd., gave the toast of "The Visitors," to which Mr. W. L. Cooper, the Commercial Attaché to the U.S. Embassy, replied. Following the toast of "The President," proposed by Sir Philip Dawson, a dance and cabaret were provided for the entertainment of the members and their guests.

Railway and Road Matters.

FROM correspondence that has appeared in the newspapers, it is evident that the purpose of the yellow light in street signals is not generally understood. Its purpose is to show that a new indication—either to "Go" or to "Stop"—is about to be given. In view, further, of some complaints that the yellow light often is exhibited simultaneously with one of the other two, we would point out that in the latest type of colour light railway signal there is only one lamp, behind which is suspended a frame carrying red, yellow and green spectacles, and only one of these can be between the light and the lens of the lamp at the same time.

ACCORDING to the Railway Returns for British Railways for 1931, the number of electric motor coaches increased by 50 during the year and the number of trailer vehicles by 91. There was, however, a decrease of 1189 in the ordinary coaches and the total of passenger-carrying vehicles at the end of the year was 49,784, a decrease of 1050, with a reduction of 30,888 in the number of seats. The average seating capacity per coach increased from 55·15 in 1930 to 55·69. The number of Pullman cars rose from 212, with 5978 seats, to 229, with 6473 seats; of the passenger-carrying vehicles on steam-worked trains only 37½ per cent. are now lighted by gas, as compared with 42½ per cent. in 1930.

DURING the forty-eight non-stop runs of the "Flying Scotsman" from July 18th to September 11th the up train arrived at King's Cross on or before time on forty-four occasions and the down train reached Edinburgh punctually or before time on forty-six days. On the other two occasions the down train was only one minute late. The up train was seven, four, and two minutes behind time respectively on three days, but was forty-five minutes late on the remaining occasion, owing to the engine developing a hot middle big end and having to be replaced. Happier conditions followed a hot middle small end on one of the down journeys. The engine had to be changed, but that was done at Newcastle and only five minutes were lost. They were not only made up in the subsequent run, but Edinburgh was reached one minute early.

AT a meeting of the representatives of the railway companies and of their men on October 14th it was stated by the latter that they could not accept the proposal that an all-round deduction of 10 per cent. in their wages should be substituted for the terms awarded by the National Wages Board in March, 1931. The companies' representatives thereupon intimated that they would take the matter to the Central Wages Board—a purely railway body—whence it will undoubtedly be referred to the National Wages Board. The railway shopmen are not directly concerned in the above proposals, as they do not come within the "conciliation" grades. The craft unions concerned, however, had a meeting with the general managers on October 4th to consider a similar reduction. The procedure in their case is that, in the event of failure to agree, the proposals go to the Industrial Court.

A LEADING article in the *Manchester Guardian* of October 11th dealt with the fog problem on railways and asked what "the companies propose to do about this annual menace to peaceful communication." After an appreciative reference to colour light signals, it says that something much more penetrating is necessary. To that we would answer that the delays to trains in foggy weather arise less from the drivers' difficulty in seeing their signals—which difficulty is almost wholly met by fog signalmen—than from other causes. Among the disabilities railwaymen labour under in fog are:—The driver has to exercise more care in entering a station so that he may stop at the right place; he cannot as readily see the guard's right-away signal and that man, in turn, has more difficulty in ascertaining that the station staff has done its work; signalmen and shunters cannot at once find where a waiting engine is standing; drivers have to set back their engines on to the trains with greater care; it is difficult to ensure that vehicles left in sidings are clear; hand signals between the platform staff, trainmen, signalmen, shunters, &c., have to be replaced by verbal instructions. True, these are all minor details, but the few extra minutes, or even seconds, required in foggy weather lead to delays which have a cumulative ill-effect.

DURING the years 1906 and 1907 there was a series of railway accidents which were not only disastrous in their results, but came about from causes which were never explained. The first of these was at Salisbury on July 1st, 1906, and the second at Grantham on September 19th of the same year. The accident at Goswick on August 28th, 1907, though it involved no passenger fatalities, was of the same character, and the last of the series was at Shrewsbury on October 15th, 1907—almost exactly twenty-five years ago. In that disaster eleven passengers, three postal attendants, the driver, fireman, and two of the guards were killed. At Salisbury a non-stop "Ocean Mail" took the severe curve at the London end of the station at excessive speed, whilst at Grantham and Goswick the trains failed to stop at the signals and entered upon sections of line that called for reduced speed. That also was the case at Shrewsbury, but the speed there was 60 m.p.h., which had been the case for some miles. As said above, no explanation could be given for the driver's inattention. The only reason Sir Arthur Yorke could think of was that the driver was sleepy and that he dozed at the critical moment. The evidence showed that for nearly a week the man had not slept in his own bed, and among the recommendations that officer made was that the duties of drivers and firemen should, as far as possible, be so arranged that no engineman should be on duty for the whole of two consecutive nights. One very unusual event followed this accident. Mr. Lloyd George was then at the Board of Trade and it was a period of unrest among railwaymen. That gentleman was speaking at Manchester on the night of the accident and he went on to the Board of Trade inquiry, which was hurriedly fixed for the following day. That unprecedented step was accompanied by another, inasmuch as the Solicitor to the Board of Trade attended the inquiry in his official capacity.

Notes and Memoranda.

THE three hydraulic turbines in the power station at Eagle Pass, Texas, which are each of 4500 H.P., are said to have an efficiency of 93·9 per cent. They are of the vertical Francis type, and work under a head of 81ft. The speed is 225 revolutions per minute.

IT is claimed that a turbine recently built by the Siemens-Schuckertwerke Company of Germany is the largest unit running at a speed of 3000 revolutions per minute. It is of 60,000-kW capacity, and takes steam at 497 lb. per square inch and from 797 deg. to 878 deg. Fah.

A LENGTH of road, just over 7½ miles long, was recently laid with 43,556 tons of asphaltic concrete in 42½ working days, of which one was lost owing to bad weather. A scientifically designed asphalt plant of large capacity was employed, together with auxiliary equipment capable of keeping pace with it.

ACCORDING to Professor J. H. Neal, head of the Department of Mechanical and Civil Engineering, Natal University College, "where current is reasonably cheap and the run is hilly, electricity on the railways is about as economical as any form of power, but for long, straight runs steam still holds its own."

WE are informed that Professor J. A. Crowther has been elected hon. secretary of the Institute of Physics, to succeed Professor A. O. Rankine. Professor Crowther was for many years a lecturer at Cambridge, and was appointed Professor of Physics in the University of Reading in 1924, and he is now also Dean of the Faculty of Science of that University.

ON account of the extremely close limits allowed for valve tappet holes in cylinder blocks, plus 0·0005 and minus 0·0001 on a 0·624in. hole, a motor car manufacturer in America found high-speed steel finishing reamers would produce only 1200 holes before being worn undersize. A tungsten carbide tipped reamer was tried and produced 72,000 holes within the limit, but the difficulty was that the reamer body wore down directly behind the tungsten carbide tips. A new reamer was made and the body chromium plated; after producing 160,000 holes this reamer was still in service.

FOLLOWING up earlier observations in Canada of the National Research Council on the effect of smelter smoke on vegetation, extensive fumigation experiments on the action of known amounts of sulphur gases in air on various crops under various conditions have been carried out and represent, says the *Contract Record*, a decidedly massive contribution to our knowledge of this subject. The Council commenced its study of smelter smoke upon the request of the Department of External Affairs, when claims totalling several millions of dollars were made by residents of the United States against a Canadian smelter at Trail, B.C.

THE application of electro-dialysis for the purification of water is of technical advantage for the elimination of salts and colloids and other matters objectionable for many processes. Three-cell apparatus is, according to E. W. Meyer, used. The salts and colloids pass through the diaphragms and the water becomes pure in the central compartment. According to the intensity of the action of the current so is the extent of the purification of the water. The equivalent of distilled water can be obtained; the energy taken is 1 to 3 kWh per 100 litres (approximately 22 gallons). The cell batteries are arranged in a series on steps, the water passing by gravity from cell to cell. Reinforced concrete is sometimes used for the cell construction.

IT is possible, according to Mr. A. Allison, to make a reasonably accurate forecast of the intensity of illumination from a knowledge of the area to be lighted and the size of the lamp, although the results based upon this minimum cannot be stated with the precision possible when more information is to hand, such as the shape of the apartment, the colouring of surroundings, the spacing and mounting height of the fittings, &c. The product of the foot-candles of illumination and the area per point can be equated to some power of the wattage multiplied by a coefficient. Assuming that the utilisation factor is about one-half and the lamp has a common type of dispersive reflector, the following empirical equation can be used, within limitations:—Foot-candles × area in square feet = $3 \cdot 75\ (\text{watts})^{1 \cdot 125}$.

ACCORDING to Mr. Charles O. Burgess, of the American Institute of Mining and Metallurgical Engineers, the addition of small amounts of chromium (0·25 to 0·50 per cent.) produced a definite improvement in the strength, deflection, and density of the cast irons investigated. On the addition of chromium, there was marked improvement in uniformity of hardness in varying sections, particularly with respect to the retention of hardness in heavy sections. A distinct improvement in the heat-resisting properties of cast iron was effected by the addition of a small amount of chromium. This improvement was related to a stabilisation of the pearlitic structure of the irons and an increased resistance to growth at high temperatures. The machinability of cast irons containing small amounts of chromium is not adversely affected even though the hardness is moderately increased.

THE latest advance in the technique of making moulded laminated paper boards of superior electrical and mechanical characteristics, is, says Mr. H. Warren, in the *Electrician*, the introduction of the Micanite and Insulators Company's product—Panilax. It solves in a fundamental manner the difficulties associated with resin distribution and penetration, and the expulsion of solvent. The resin, in the form of a fine precipitate is actually added to the paper pulp in the beater, and goes, suspended in the "stuff" into the stuff chest of the paper machine. The finished paper looks exactly like ordinary paper, but it contains, perfectly diffused throughout its mass, some 50 per cent. of resin of high electrical quality. When a stack of this paper is moulded up into a board the product has a far more homogeneous structure than that of the normal cemented paper boards, and its properties are definitely superior. This material is just about to go into commercial production, and several of the large electrical concerns have already had very good results from trial applications.

Miscellanea.

THE new submarine "Seahorse" will be launched at Chatham Dockyard on November 15th.

ACCORDING to the *Natal Mercury*, the cost of coal at the pithead of the local mines is from 3s. to 5s. a ton.

THE power stations at Colenso and Congella, South Africa, are to be interconnected by an 88,000-volt line.

THE Springs Mines, Transvaal, are installing two large Allis-Chalmers ball mills to replace the existing stamp battery.

THE Ferry Tin-plate Works, Briton Ferry, have re-started after nine months, and 250 employees are re-engaged.

WORK has been started on the construction of the Clanwilliam Dam across the Olifants River, South Africa. The estimated cost is £360,000.

ITALY'S new 48,000-ton liner "Conte di Savoia" is now in dry dock for final examination. During her trials she is reported to have averaged 27½ knots.

SOME large deposits of molybdenum concentrates have been found at Mammoth, Arizona, and are to be worked by the Molybdenum Corporation of America.

IT is suggested that the grain storage capacity of the port of Montreal should be increased by the addition of silos capable of holding fifteen million bushels.

ACCORDING to a correspondent of *Indian Engineering*, some 26 million cubic feet or about one-half of the total of the Mettur Dam in Madras has been put in place.

A LARGE mineralised zone, containing gold in massive quartz and sulphide reefs, silver, copper, lead, zinc, iron and mica, has been discovered by Captain D. Bondurant, an American aviator, in the hinterland of Labrador.

A COAL washing plant, by the Rheolaveur Washery Company, of Nottingham, is to be put up by the South African Coal Estates, Ltd. It will have a capacity of 300,000 tons a year and will be the largest in South Africa.

ANOTHER stage in the Mersey Docks and Harbour Board's £250,000 scheme for the modernisation of dock bridges at Birkenhead and Liverpool has been reached by the opening of the second of four rolling bascule bridges on the Birkenhead side.

A RECORD for loading grain at Sorel, Quebec, was established when the steamer "Wearwood," owned by Joseph Constantine Steamship Line, Ltd., of Middlesbrough, was loaded with 264,000 bushels of wheat, approximately 7071 tons, in seven hours.

THE Deutsche Lufthansa, the German air line combine, has decided immediately to put an aeroplane fitted with the Junkers Diesel aero-engine on the Berlin–Amsterdam line. The engine is of 600 H.P. and weighs 1760 lb. The fuel consumption is 0·36 lb. per H.P. hour.

THE first vacuum still used in America for the production of lubricating oil, in 1866, has been presented to the Edison Institute of Technology at Dearborn, Michigan, by the Vacuum Oil Company. Some of the men who ran the still before it was dismantled are supervising its re-erection.

THE fusion of two of Sweden's oldest and best-known industrial companies—the Bolinder and the Munktell Mechanical Works—has just been completed. The bigger of the two concerns, the Bolinder Works, has been active since 1844 and the Munktell Company this year celebrates its hundredth anniversary.

THERE is now on view in the Blue Funnel show-room in India-buildings, Arcade, Liverpool, a reproduction of a contemporary model of a first-rate man-of-war of the Stuart period of about 1680, which has been constructed by Mr. Sydney H. Johnston, M.I.N.A., assistant naval architect to Messrs. Alfred Holt and Co.

DURING the next five years it is proposed to extend many Russian shipyards and engine works and the draft plan of shipbuilding covers the construction of the following vessels:—290 cargo and cargo passenger ships, 161 trawlers, 200 tugs, 27 dredgers, 11 hydrographical vessels, and 11 icebreakers. There is also a large constructive plan for river vessels.

THE report of the Imperial Airways for the current year shows that more passengers have been carried on its European services during the past six months than in the whole of the last financial year. For the half-year ended September 30th last 37,465 passengers were carried, compared with 30,624 for the whole of 1931–32 and 28,499 in 1930–1. The half-yearly figures for the Empire services are also substantially higher.

IT is reported by the National Federation of Iron and Steel Manufacturers that there were fifty-nine furnaces in blast at the end of September, a net increase of two since the beginning of the month, four furnaces having commenced operations and two having been blown out. Production of pig iron in September amounted to 260,400 tons, compared with 259,400 tons in August and 248,200 tons in September, 1931. The production includes 50,900 tons of hematite, 126,600 tons of basic, 69,200 tons of foundry, and 8200 tons of forge pig iron. The output of steel ingots and castings in September amounted to 430,300 tons, compared with 361,500 tons in August (when production was affected by holidays) and 400,500 tons in September, 1931.

THE Secretary for Mines announces the publication of the report for 1931 of Mr. J. A. B. Horsley, H.M. Electrical Inspector of Mines. Progress in electrical development at mines under the Coal Mines Act is analysed therein in detail. Electricity was used at 1409 mines out of a total of 2243, and the horse-power of motors installed at June 30th, 1931, was 1,833,536, or 17,000 horse-power greater than at June 30th, 1930. The statistical tables include a regional analysis of the horse-power of motors installed, showing the extent to which "direct current" and "alternating current" respectively are used, and giving analyses (with comparative figures for ten years) of fatal accidents. There were twenty-four lives lost in eight fatal accidents attributable to the use of electricity during 1931.

CONSTRUCTION OF WATER SUPPLY TUNNEL No. 2, NEW YORK

(For description see page 398).

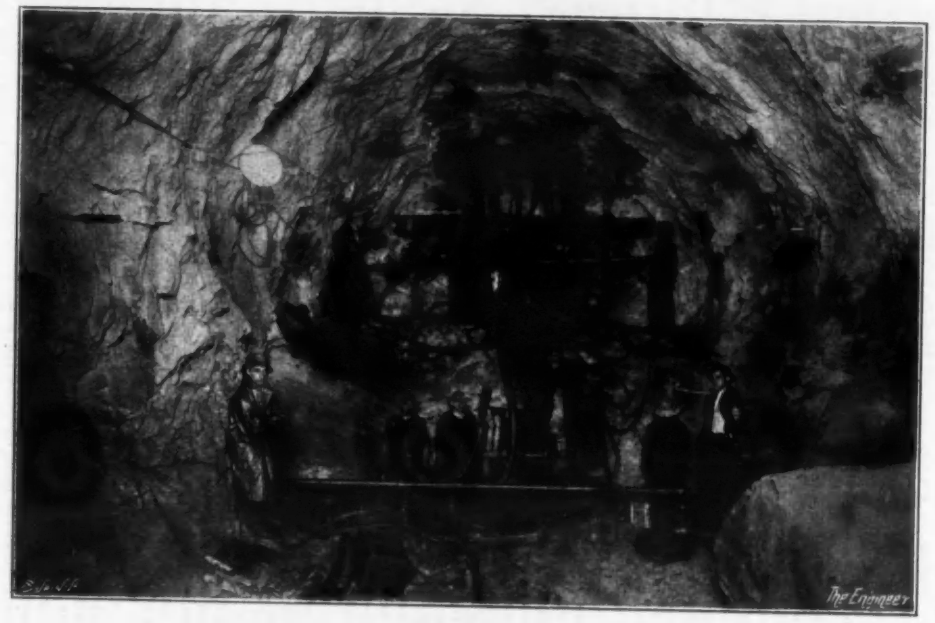


FIG. 14—DRILLING CREW AND EQUIPMENT

FIG. 15—AIR SHOVEL AT A HEADING

FIG. 16—ONE TYPE OF STEEL ROOF SUPPORT

FIG. 17—CONCRETE SAFETY BULKHEAD AND MUCKING PASSAGE

NEW WATER SUPPLY TUNNEL FOR NEW YORK CITY

FIG. 18—FULL CIRCLE ROOF SUPPORT UNDER THE BRONX RIVER

FIG. 19—ERECTING STEEL ROOF SUPPORT UNDER THE BRONX RIVER

FIG. 20—VIEW SHOWING TOP CENTRE DRIFT WITH NEEDLE BEAMS

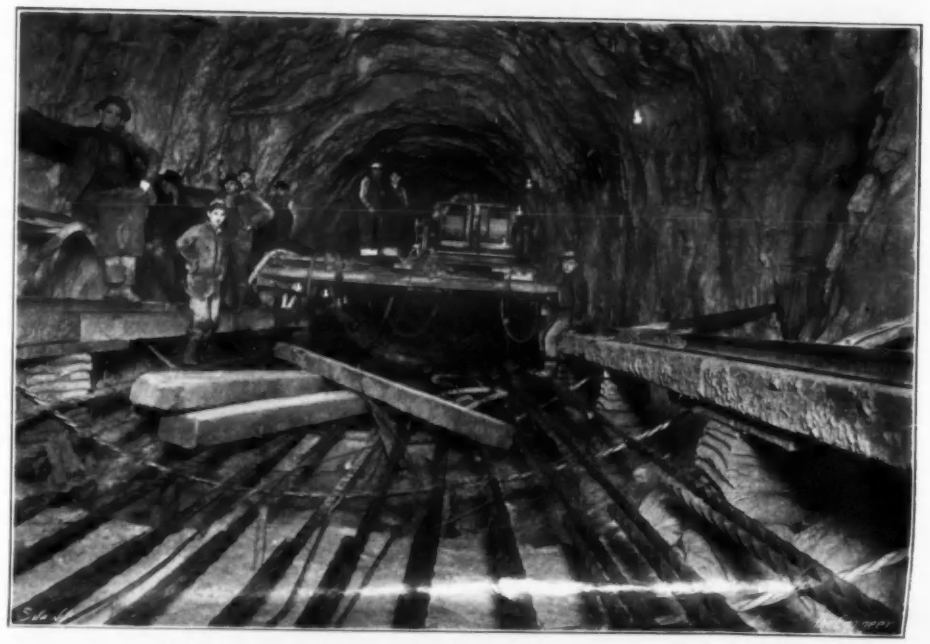


FIG. 21—VIEW SHOWING REINFORCING BARS FOR THE INVERT

FIG. 20—VIEW SHOWING TOP CENTRE DRIFT WITH NEEDLE BEAMS

FIG. 21 VIEW SHOWING REINFORCING BARS FOR THE INVERT

FIG. 22—VIEW SHOWING REINFORCING BARS AND SIDE WALL FORMS

FIG. 23—UPPER DECK OF CONCRETE-GUN JUMBO

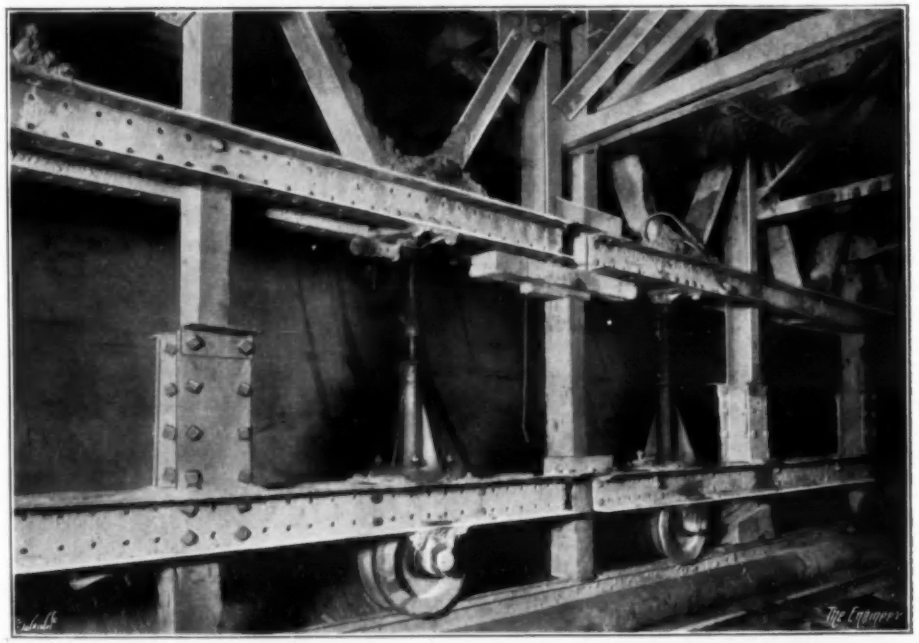


FIG. 24—UNDER THE STEEL ARCH FORM

FIG. 25—COMPLETED SECTION OF 17-FOOT CONCRETE TUNNEL

The Engineer

OCTOBER 21, 1932.

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**** No undertaking can be given to return drawings or manuscripts; correspondents are therefore requested to keep copies.*

THE OTTAWA AGREEMENTS.

A DEBATE on the Ottawa Conference was opened in the House of Commons on Tuesday last. Whatever course it takes, it can make no material difference to the final result. The representatives of His Majesty's Government made solemn declarations that they would do certain things. The representatives of Dominion Governments and the Government of India made, on their side, equally solemn declarations. The Parliaments of several Dominions have already ratified the engagements made by their Governments. It is wholly unthinkable that the Parliament of the United Kingdom will desire to rescind or modify a single one of the promises made by the representatives of the British Government. Hence we may take it as certain that the terms of the Trade Agreements settled by the Economic Conference and made public last week will, where they have not already done so, come into force. It is not necessary for us to set down here the nature of those terms. They have already been widely circulated, and each trade or industry has had time to form some opinion on their adequacy or probable effects. With regard to those in which we are primarily interested, it is sufficient to say that they have been well, if not enthusiastically, received, and it is acknowledged that, particularly in the agreements with Canada and India, valuable concessions on the importation of engineering products have been secured. In many cases the importation duties have been entirely withdrawn, and in others reduced, in favour of the United Kingdom and other parts of the Empire. It is unnecessary to say that reciprocal concessions have been promised by Great Britain. With the exception of copper, zinc, and lead, the imports affected are principally foodstuffs, and a discussion of them is outside our ambit.

When the Conference had completed its task, the King sent to it the following message: "Your work has been arduous and intricate, but I rejoice to think that your achievement has justified the high expectations with which the Conference began, and that you have been able not only to conclude important practical agreements for the promotion of trade within the British Empire, but also to adopt principles to help its future development." Whilst there are not wanting a few who profess that nothing at all has been accomplished, the majority, a vast majority, is satisfied that if all that was desired has not been attained, yet the agreements secured will foster Imperial trade and, furthermore, that—which we count more important than the actual modification of import tariffs—a valuable step has been taken towards a far more complete Imperial Economic pact. For whilst it is undeniable that the substantial agreements are based wholly upon duties, it should not be forgotten that other matters, which being less concrete are apt to escape attention, were discussed at the Conference. We may mention as an example of especial interest a Resolution concerning Industrial Standardisation. Difficult as the subject is, progress is being made towards Imperial standards, and we have no doubt will be furthered by the debates at Ottawa. Another resolution of a different order, but of at least equal importance, is concerned with Industrial Co-operation within the Empire. These are the words of the essential part of this resolution: "It should, in the opinion of the Conference, be the object of any policy of industrial co-operation within the Commonwealth to secure the best division of industrial activities among the several parts of the Commonwealth, and the ordered economic development of each part, with a view to ensuring the maximum efficiency and economy of production and distribution." We are disposed to think that activities such as those adumbrated in these two resolutions may, in the event, prove of more general benefit than manipulations of tariffs which can hardly escape from international repercussions. If, for example, we take the case of Canada alone, and remember the great extent of the American capital in that Dominion, it is difficult, nay impossible, to believe that American manufacturers will not make every effort to preserve their trade, despite the special concessions made to the countries of the Empire. Whilst we do not suggest that the Empire can ever be bound together by sentiment, and whilst we are not blind to the solid and obvious effects of tariff agreements, we are inclined to the belief that Imperial rationalization may, if it can in the course of time and with the direction of supreme statesmanship be achieved, prove itself a more permanent bond than that which is presented by the opening of doors through tariff walls. It is interesting in this connection to turn to a memorandum drafted and issued by the Federation of British Industries before the report on the Economic Conference was issued. "The primary objective of immediate British Commercial Policy," says this memorandum, "should be to restore freedom of flow to world trade. This involves taking active steps to secure the removal of the present abnormal restrictions, the re-establishment of the international interchange of goods on a satisfactory basis, and in general the promotion of complementary trade development and investment between the different areas of the globe along lines similar to those which operated before the war." Furthermore, the F.B.I. "submits that the system of world trade and exchange has become so strained and dislocated as to be incapable of restoration by mere tariff negotiations as ordinarily understood."

We have already repeated a few sentences from the message sent by His Majesty to the Ottawa Conference when its work was done. In a message sent to it and read by the Governor-General at the opening session the King said: "The British Empire is based on the principle of co-operation, and it is now your common purpose to give the fullest possible effect to that principle in the economic sphere. By so doing you will set in motion beneficial forces within the British Commonwealth which may well extend their impulse also to the world at large." Those words open a vision of a larger statesmanship. A step towards it has been made by the furtherance of economic co-operation within the Empire achieved by the Conference at Ottawa. But it is in the highest degree improbable that the fullest development of the resources and abilities of the Empire can ever be made within an Imperial stone wall. International trade is no less vital than Imperial trade. "There needs to be," said Sir Francis Goodenough a few days ago, "a thorough exorcising of Fear and a great accession of Good-will and Faith amongst all the nations, and Disarmament all round—fiscal as well as military and naval—or we shall perish from our foolish and mutually destructive efforts, our suicidal attempts to hinder each other's progress and diminish each other's prosperity." Taking the largest view, we shall look forward hopefully to a day when negotiations between the Empire and other nations of the globe will effect agreements that will enable all by the development of complementary industries, wisely and generously conceived, to enjoy to the utmost the fruits of their energy, their enterprise, their knowledge, and their labour.

The Electrical Industry.

THE period of Presidential Addresses which gives scope to those endowed with the gift of talking, even when there is really nothing of importance to say, is again with us. Whether in the aggregate the world would be much worse off without Presidential Addresses is a matter upon which widely differing opinions are probably held, but in any case it may be taken for granted that many look forward with interest to what a new President or Chairman of an engineering or scientific body is going to say. That the performance does not always come up to expectations and send one home with the feeling of having ended a perfect day, many in the habit of attending opening meetings have good reason to know. The President's subject has perhaps been "done to death," or it may have been so specialised and involved that it only appealed to a few. An experienced and gifted lecturer who really has nothing very new to say may easily draw louder and longer applause than a much better-informed but less qualified speaker. As a rule, the man with a good general knowledge and the ability to say what has been said before without making the fact too obvious will be better appreciated than an individual who confines himself to a specific subject which probably few understand.

A good example of the type of address that covers things in general was delivered by Mr. Cecil Livesey before the Mersey and North Wales (Liverpool) Centre of the I.E.E. on Monday last. The subject was "Some Aspects of the Electrical Industry in relation to Great Britain's Economic Position," but, contrary to what might be supposed, political and fiscal considerations were left alone. Nevertheless, at the outset Mr. Livesey laid stress on the fact that the welfare and prosperity of Great Britain are dependent to a large degree on the successful exportation of a substantial proportion of the country's productions. Although that, of course, is well understood, there are people who appear to imagine that all will be well as long as big schemes are kept going in this country. When the "grid" has been completed the main line railways must be electrified, and when that task has been accomplished, other big jobs in this country must presumably be found. One might almost imagine, in fact, from the utterances of some that the main thing this country needs is plenty of electricity. But never has it been more essential to realise that our prosperity is governed largely by the ability of the British manufacturer to sell his goods abroad. Anticipating the revival of industry and commerce, Mr. Livesey confined himself to the question of what the electrical industry is doing in regard to research and development, marketing and distribution, to improve its competitive efficiency, so as to expand its trade in overseas markets. Since the war there have been innumerable calls for more research in order to enable this country at least to keep abreast with others. But at the moment we doubt if all manufacturers are likely to view the matter of spending more money on research in a very favourable light. Bad business generally leads to cuts, and research, we are afraid, is one of the things most likely to be affected. Of course, it can easily be shown, especially by research workers, that the policy of cutting down expense in this direction is wrong, even in the most depressed times. The country must be ready to meet foreign competition when more favourable conditions arrive, and there is much to be said for the policy of continuing to support research. Like others, Mr. Livesey drew attention to the good work of the Electrical Research Association, and suggested that it should be more widely supported, and its activities extended. Few doubt that the Electrical Research Association serves a useful purpose, but we have often wondered to what extent its results are utilised by manufacturers. As everyone knows, the Association has devoted a great deal of time, and we imagine a very fair amount of money, to new methods of circuit breaking, yet how many British firms, we should like to know, are producing anything but orthodox types? The new commercial developments in this field seem to

emanate from the works of foreign firms, which have probably taken practical advantage of British investigations. Research is not likely to prove very beneficial to industry and help manufacturers to increase their export business unless it is followed up by new developments in the workshop. Practical developments of research are obviously essential, and Mr. Livesey suggested that the Research Association's activities might be extended by the provision of a properly equipped workshop for making up experimental pieces of apparatus. Other suggestions made were that the Association might carry out standard tests upon the products of manufacturers who cared to submit their apparatus, and that a central testing station might be provided for making rupturing capacity tests on circuit breakers. The desirability of establishing such a station has, of course, often been emphasised. There is at present one privately owned station, but many point to the advantages of a central station built for the benefit of everyone concerned. With the knowledge that the rupturing capacity of all circuit breakers was based on something more than guesswork, purchasers would surely feel more safe and the manufacturing and supply sides of the industry would benefit alike.

One of the tendencies, Mr. Livesey explained when discussing manufacture, is for an increasing number of firms to embark upon the manufacture of an increasingly wide variety of machinery and apparatus, with the result that there are many firms making more kinds of goods than they can profitably find a market for. This policy of extending manufacturing activities into all sorts of fields, irrespective of what other manufacturers are doing, has not always been beneficial to the firms that have adopted the policy. On the contrary, it has often been the reverse, and it is high time that some firms paid more addition to their limitations. Apart altogether from the effect on the firms themselves, manufacturers who attempt to make too many kinds of goods impair rather than increase their chances of supplying foreign markets. Instead of a number of firms taking up the manufacture of apparatus already marketed by other firms, it would surely be better for them to concentrate upon a limited number of goods which can be manufactured efficiently and economically.

The Institution of Mechanical Engineers in America.

No. IV. (*conclusion.*)*

Rochester.

Immediately after breakfast on Tuesday, September 6th, the party left the Clifton Hotel at Niagara and, crossing the International Bridge, boarded a special New York Central train for the purpose of proceeding to Rochester. Our first visit after our arrival at that city was to the Park Works of the Eastman Kodak Company. The tour through these works was not particularly instructive. They are devoted to the manufacture of photographic films, papers and chemicals, the company's cameras and lenses being made at other works in the city. We were conducted at the outset through the film-winding and packing department. In the dim-red light of the work-rooms it was just possible to distinguish innumerable girls operating machines which our imagination more than our eyes told us were rolling cut-off lengths of film on to the familiar spools, wrapping them in paper and foil coverings and packing them in their little yellow boxes. Subsequently we were shown the paper-coating machines in which "Velox" and other photographic printing papers receive their sensitive emulsion. The machines were housed in dimly lit chambers at the beginning of which the paper, in the form of a large reel, was coated by means of rollers and through which it was thereafter carried in festoons until it emerged in a dry state at the other end ready for cutting up into sheets. The department in which the company makes its own paper was also inspected. The equipment, while of a very fine nature, resembled that of an ordinary paper mill, except in so far that it was supplemented by coating machines for applying to the finished paper a coating of barium sulphate to protect the sensitive emulsion, applied later, from the action of any deleterious chemicals which might by chance be contained in the raw paper. The inspection of the works concluded with a visit to the company's private cinema theatre, in which the results of recent developments in musical and sound films were demonstrated. We left the theatre satisfied that until then we had greatly undervalued the realism and artistic merits of such films at their best.

Following luncheon at the Kodak Works by invitation of the Eastman Company, the party subdivided to visit other places of interest in the city. One section inspected the establishment of the General Railway Signal Company, and studied the manufacture of electric interlocking, automatic block signalling, automatic train control, and other railway equipment of a like nature. The company's electric interlocking equipment provides a system for controlling and operating switches and signals from a central situation, the manipulating levers being interlocked in such a way that their movements must succeed each other in a predetermined order. A machine with provision for 576 levers has recently been installed by the company at the Cleveland Union Terminal and is claimed to be the largest power interlocker in the world.

Another section of the party inspected the works of the Stromberg-Carlson Telephone Manufacturing Company. This company was established in 1894 by two Swedish employees of the Chicago Telephone Company. In 1902 the business was acquired by certain Rochester gentlemen and removed to that town. The greater part of the company's stock is now held by its officers and workpeople. For the first twenty-seven years of its existence the company produced telephone apparatus almost exclusively, but within the past few years about 60 per cent. of its production has consisted of wireless apparatus. We found it established in a very spacious and pleasantly situated one-storey factory, which had been completed in 1929. The level of activity was, however, much below the capacity of the plant, for the prevailing hard times have had a decidedly restrictive effect on the sale of high-class wireless sets. At these works we touched the fringe of broadcasting in the United States. As an advertising medium its value seems to be universally accepted, but it is doubtful in our minds whether it is always as effective in that direction as those using it for the purpose might wish. We heard, for instance, of an extensive programme campaign designed to draw attention to the merits of "Y's" toothpaste. It was quite successful, so we were told, for many listeners were now convinced of the importance of dental hygiene and were brushing their teeth three times a day regularly. The toothpaste used, in the cases reported to us, was not, however, "Y's," but a rival brand.

Schenectady.

Leaving Rochester in the late afternoon, the party proceeded by train to Schenectady, where the night was spent at the Van Curler Hotel, on the banks of the Mohawk River. The following morning, September 7th, was devoted to a visit to the works of the General Electric Company. This company now owns factories in more than twenty-five cities. The Schenectady establishment is not only the largest of them all, but is the seat of the company's principal administrative offices. The company's history dates from 1892, when it was founded by the amalgamation of the Edison General Electric Company and the Thomson-Houston Electric Company. By that amalgamation two great scientists and inventors, Thomas Alva Edison and Elihu Thomson, were brought together to the great benefit of the infant electrical industry. With them, in the service of the company, others whose names and achievements are of international repute should be associated. Steinmetz, the brilliant mathematician and electrical engineer; Emmet, a pioneer in the development of the turbo-generator, and of the electrically propelled ship; Whitney, who developed the metalised filament; Coolidge, the discoverer of a practical method of drawing tungsten into wire and the inventor of the high-power X-ray tube which bears his name; Irving Langmuir, whose researches resulted in the production of gas-filled incandescent lamps, and in the development of broadcasting equipment; these and other names are numbered among those of the men who have served, or are still serving, within the company's organisation.

In its early days the company produced incandescent lamps, small dynamos and motors, and electric cable. To-day its manufactures cover every corner of the electrical field. As witness of the growth which has occurred in the industry since the company was founded, mention may be made of the General Electric steam turbo-generator of 5000 kW capacity which was installed at Chicago in 1903 by the Commonwealth Edison Company. That machine in its day was considered a wonder, but in 1930 the General Electric Company supplied for use at the State Line generating station in the same city a compound turbo-generator of 208,000 kW capacity. In hydro-electric plant the development has been almost equally striking. In 1902 the company supplied one of the first hydro-electric generators for harnessing the power of Niagara. Recently it dispatched from the Schenectady works four such generators, each of which has a capacity of more than 100,000 horse-power.

Last year, a poor one for the company, the number of its employees averaged 65,516, not counting those in the service of its numerous associated companies throughout the world. At the Schenectady works alone the daily population amounts to between 18,000 and 20,000 men and women. These works cover an area of 645 acres, and comprise 353 separate buildings. During our visit we had time to walk round barely more than the largest department, that devoted to the manufacture of steam turbo-generators. Following our hurried and partial inspection of the shops, we assembled in the lecture hall of the company's laboratory. Research plays a high part in the General Electric organisation, not only routine laboratory work, but scientific investigations of a primary order conducted without thought or reference to immediate commercial exploitation. In 1901 the research laboratory was established in a small one-storey shed-like structure, and was staffed by Dr. W. R. Whitney and a single assistant. To-day the department is housed in two large buildings, and Dr. Whitney, still in charge of it, has under him a staff of more than 400 physicists, chemists, and engineers. In the sumptuously furnished theatre we were entertained for over an hour to an experimental demonstration and lecture, illustrating some of the studies which the department has recently been making. The range covered was wide. It extended from the effects of X-rays in accelerating and modifying the growth of grape-fruit seedlings to the transmission of music along a beam of light with the aid of photo-electric cells. Subsequently the party partook of luncheon in the works restaurant by invitation of the company and the Schenectady section of the American Society of Mechanical Engineers.

The Hudson River and New York.

A few of the members remained behind at Schenectady to visit during the afternoon the General Electric Company's broadcasting station, the American Locomotive Works, or the Union College, and thereafter travelled to New York by train. The majority of the party had, however, elected to proceed to the same destination by taking the train to Poughkeepsie on the Hudson and thence voyaging 72 miles down that noble river by steamer. Of *Pokkipsey* we know nothing, except the peculiar pronounciation of its name. It served us merely as a convenient point for embarking on the Hudson Day Line steamer "De Witt Clinton," a wholly unromantic shallow-draught multiple-deck construction, bearing more than a fanciful resemblance to a floating grandstand. Nevertheless, the journey from Schenectady to New York was one which, so far as the route was concerned, could scarcely be performed without a thought for the colourful times that have gone. Long before railways and river steamers came to make travelling easy, the Hudson was a highway up which the voyageurs and adventurers of old passed in their batteaux and canoes on their way to the frontier post of Albany. Turning westwards, they would ascend its tributary, the Mohawk. A short portage through the territory of the Six Nations brought them to Wood Creek and Lake Oneida, whence they would pass by way of the Oswego River to Lake Ontario and the vast inland waterways of Canada. Or, continuing north past the mouth of the Mohawk, they would set their light craft afloat on Lake Champlain, and traversing its length would descend the Richelieu River, and eventually paddle out on to the broad St. Lawrence, about half-way between Montreal and Quebec.

Fittingly, indeed, have these waters been called "the warpath of the nations." Over them passed the Iroquois and their bitter enemies, the Algonquins. By them came the Dutch to settle at Schenectady and the English to establish themselves at Albany. They were used by Champlain and Frontenac to wage war against the redskin, by French jesuits bent on his salvation, and by English fur traders determined to rob him. German and Swiss legionaries in Britain's service, Abercrombie and the "Black Watch" passed that way to fight, and mostly to die, at Ticonderoga. Amherst followed to avenge them, and to drive the French finally back into Canada. Then came Allen and his "Green Mountain boys" of the Revolutionary War, and later Burgoyne to win a passing victory and suffer a defeat, stupendous in its consequences, at Saratoga.

Past Newburgh, with its memory of Washington and his descent on Cornwallis at Yorktown, past Westpoint, where the military academy clings to the river's edge still dreaming perhaps of Arnold's treachery, past Haverstraw, where Major André landed to be captured and executed by the Americans, our vessel glided on until long after dark the lights of New York appeared ahead, and seemed to shout to us to forget the past and live only for to-day. And from the moment of landing at the West 42nd-street pier until we left homeward bound in the "Samaria," fifty hours later, we had little leisure and no inducement to do otherwise. Through the gloom of dock-land, across a veritable river of glaring, flaunting lights which we learnt was Broadway, we were driven to the Waldorf-Astoria on Park-avenue, and were introduced to the very latest and largest example of America's hotels. What connection the hotel has with the first John Jacob Astor and his humble birthplace at Waldorf in Germany, we do not know. This much, however, we heard of its history. The earlier hotel of the same name, finding taxes rising until they reached a rate equivalent to about 2 dollars per night per bedroom, had no alternative but to sell its site to Mr. Al Walker, who desired to build upon it the 102-storeyed Empire State Building, and to re-erect itself elsewhere with 2000 bedrooms—and 2000 bathrooms—elongated skywards, in order that its site valuation per room might be reduced to a reasonable figure.

On the morning of Thursday, September 8th, we

* No. III. appeared October 14th.

were whisked off to visit the American Telephone and Telegraph Company's Transatlantic and long-distance exchange, and other establishments of telephonic interest. After lunch we set forth on a long drive which took us at first through the Harlem negro quarter of the city, thence past many miles of petrol pumps and motor car wrecking stations, through Hutchinson River Parkway—where there are no footpaths and where speeds of less than 30 m.p.h. are punishable as loitering—to "Playland" on Long Island Sound. We have no certain knowledge as to why we were taken to "Playland," but we suspect it was because it was desired to give us first-hand evidence that all amusement centres in the United States are not conducted on the lines of Coney Island, and that some of them at least are quite dull and respectable. Of the return journey little perhaps need be said. Briefly, our drivers and guides lost their way in the desolate streets of Hoboken, searching for the Stevens Institute of Technology. Half the party eventually arrived at it at 7 p.m., to find Dr. Davis still patiently waiting to provide us with afternoon tea. The evening, or what was left of it, was free for private engagements, and most of the members took advantage of the opportunity to visit the Empire State Building, the Roxy Cinema Theatre, the *New York Times* offices—or other places of amusement.

If our sightseeing drive on this day left something to be desired in the way of organisation and speed, our experiences on the morning of the following day, Friday, September 9th, provided us with more than compensation. Four separate expeditions were on the programme. One consisted of a visit to the Colgate-Palmolive-Peet Company's works at New Jersey, followed by an inspection of the New York Edison Company's East River power station. Another covered a visit to the Hell Gate power station. A third comprised a trip to the works of E. W. Bliss and Co., the American Machine and Foundry Company's establishment, and the Hudson-avenue power station. The fourth consisted of an inspection of the Federal Shipbuilding and Dry Dock Company's shipyards.

We can speak from personal knowledge concerning only the first named of these visits, but we understand that similar arrangements were made for the others. Starting from the hotel, our journey required us to traverse the streets of New York until we came to the Holland Tunnel, by means of which we passed beneath the Hudson and reached the Colgate works in Jersey City on the other side of the river. Thereafter, we returned by way of the tunnel and for a second time cut across the New York streets in order to reach the East River power station. Finally, we had to return to the hotel. The three points defined by the Waldorf-Astoria, the entrance to the Holland Tunnel, and the power station, lie at the apices of a triangle, having a periphery of about 9 miles, and containing within it the very busiest centres of downtown New York's financial, business, and shopping life. Normally, progress through this area is painfully slow, for at the corner of every "block," traffic signals are installed and must be obeyed. A mobile police patrolman, or "speed cop," armed with a revolver and cartridge belt, had, however, been detailed to take charge of us, and to precede our motor coach. How, or by whom, his services had been secured we did not discover. The result, nevertheless, was electrifying. At the shriek of his syren, echoed down the streets between the tall buildings, traffic cleared like magic from our path, policemen sprang up to hold back all other road users and we were given the undisputed right of way. Without a stop, a passage was blasted for us through New York's congested streets, and at 40 miles an hour we tore along behind our police escort, indifferent alike to red or green lights, and to the right or the wrong side of the road. We enjoyed the experience and appreciated the privilege, but we felt that Mr. Taylor's subsequent apology to the inhabitants of New York at large for the inconvenience and delay which our journey through their streets must have caused them was more than due.

A luncheon at the Waldorf-Astoria, to which we were entertained by the New York and Brooklyn Edison companies was followed by a final sight-seeing drive through Greater New York—without police escort. In the evening we were invited by the American Society of Mechanical Engineers to join its members at dinner. From the banquet room we passed straight to the motor coaches, and were driven to the docks. Punctually at midnight the Cunard liner "Samaria" cast off, and our homeward voyage began. As we slipped quietly down past Battery Point and the Statue of Liberty, New York and its tall lights assumed a fresh aspect. It seemed almost a dream city of castles perched mysteriously on illuminated pinnacles of rock. Its ceasless roar and bustle had vanished, and its grotesque buildings no longer weighed us down with a sense of our puniness. Its strident pursuit after pleasure and power became silent, and it appeared to reacquire the peace which Manhattan Island knew before Peter Minuit bought it from the natives for twenty-four dollars' worth of trinkets.

The Homeward Voyage.

Of our return trip across the Atlantic, little of note falls to be recorded. During the first two days at sea, Saturday and Sunday, September 10th and 11th, we experienced a gale, or the tail end of one, which, moving eastwards, so we learned on board, had caught the "Scythia," 300 miles ahead, with its full power and had forced the "Manhattan" to hove-to for twenty-four hours. On the Monday it became calmer, and by the Tuesday it was quiet enough to permit the worst sailors among our company to appear on deck. On the Wednesday we overtook the "Lancastria," steaming eastwards like ourselves. She was the only vessel which we saw throughout the voyage, with the exception of some trawlers which loomed out of the mist off the south coast of Ireland. During Saturday, September 17th, thick fog descended upon us at the mouth of the Channel, and it was after midnight before we crept into Plymouth Sound to anchor and disembark some of our passengers by tender. We were soon away again, and, the fog clearing, we made Le Havre in bright sunshine at lunchtime on the Sunday. Off again, we continued up channel, and in due time retired, for the last time, to our berths, with the lights of Dover slipping past on our port quarter. Next morning on awakening we found the ship tied up alongside the quay of King George V. dock, and the trip was at an end.

Obituary.

HARRY ARTHUR RUCK-KEENE.

Widespread regret will be felt among marine engineers and naval architects at the announcement of the death, at the comparatively early age of sixty-six, of Mr. H. A. Ruck-Keene, the Chief Engineer Surveyor of Lloyd's Register of Shipping. Mr. Keene had been ill at intervals during the last few months, and he died at his home at Finchley on Friday, October 14th.

He was the third son of the Rev. Benjamin Ruck-

H. A. Ruck-Keene

Keene, the late Rector of Copford, near Colchester, and was born on November 18th, 1865. He was educated at Cheltenham and on the Continent, and served his apprenticeship on the Tyne in the engine works of Sir W. G. Armstrong, Mitchell and Co. and R. and W. Hawthorn, Leslie and Co. In the course of his work with the latter firm he was assistant to the outside manager, and gained experience in fitting the boilers and machinery on board naval vessels, as well as a knowledge of the problems of naval architecture. On leaving the Tyne he was, in 1890, appointed an engineer surveyor to Lloyd's Register of Shipping. He served the Society at Middlesbrough, London, and Antwerp, and in 1907 was appointed principal surveyor on the staff of Dr. James T. Milton, who was at that time Chief Engineer Surveyor. In the following year he became assistant to Dr. Milton, and on Dr. Milton's retirement from active service in October, 1921, succeeded him as Chief Engineer Surveyor.

Mr. Ruck-Keene was a pioneer in this country in the development of autogenous welding for boiler repairs, and as far back as 1907 contributed a paper on "The Welding of Structural Materials in Place," at a conference of the Institution of Civil Engineers. This paper, which was one of the first contributions to a British technical institution dealing with this method of repair, was recorded in our issue of July 5th, 1907. In the same year he read a further important paper on "New Methods of Effecting Boiler Repairs" before the Institute of Marine Engineers.

In the course of the long term of high office in the service of Lloyd's Register of Shipping, Mr. Ruck-Keene was recognised as a leading authority on the far-reaching developments which took place in marine propulsion. These often necessitated amendments and additions to the Society's Rules. Some of the more important subjects which occupied Mr. Ruck-Keene's attention were Amended Rules for Boilers and New Rules for Water-tube Boilers, New Rules for Petrol, Paraffin, and Heavy Oil Engines, including Double-acting Engines, New Rules for Refrigerating Machinery and Appliances aboard ships, and Rules for Frozen Meat Stores and Refrigerated Railway Cars. Other matters were New Rules for Steam Engine Shafting and the Survey of Electrical Installations. He was a Vice-President of the Institution of Naval Architects and of the Institute of Marine Engineers, and was also a member of the Institution of Civil Engineers, the Institute of Metals, the Iron and Steel Institute, the North-East Coast Institution of Engineers and Shipbuilders, and the British Association of Refrigeration.

Mr. Ruck-Keene coupled his wide technical knowledge and varied experience with a charm of manner which endeared him alike to his colleagues on the staff of Lloyd's Register and to his many business friends. His death is greatly deplored by the members of the Committee of Lloyd's Register of Shipping, to whom during long years he rendered most valuable service.

Literature.

SHORT NOTICES.

Testing Radio Sets. By J. H. Reyner. Second and revised edition. London: Chapman and Hall. 1932. Price 10s. 6d.—We are not surprised that a second edition of this valuable book has been called for, and we notice with pleasure that Mr. Reyner has added a chapter on the testing of super-heterodyne receivers, which appear to be rapidly returning to favour. We observe, too, that in several places expansion of the text has taken place and that the section on laboratory testing has been enlarged. From practical experience we can safely commend the volume, not only to those whose business is "wireless," but to amateur constructors and experimentalists.

Wire Splicing. By R. Scot Skirving. Glasgow: Brown, Son and Ferguson, Ltd., Darnley-street. 1932. Price 2s. —Although this little book is primarily intended for the seaman and amateur yachtsman, it may be fittingly mentioned in these columns because engineers have frequently to make splices in wire ropes for cranes, hoists, and kindred appliances. There will, we suspect, always be differences of opinion about the making of splices and the partisans will heartily and forcibly condemn the methods of their opponents. All that Mr. Scot Skirving can do, therefore, is to present the methods which he deems best with some reserved remarks on other methods. It may be doubted if anyone can learn to make a good splice from a verbal description, and as we have not put Mr. Skirving's instructions to the test we can only say that they appear to be lucid and that the photographic illustrations seem to be more convincing than the usual sketches. We may add that as an instructor the author shows a human touch which will appeal to all who have had to struggle with a large wire rope for the first time.

Technical Data on Fuels. Edited by H. M. Spiers. Third edition. London: The British National Committee, World Power Conference. Price 12s. 6d.—This book is already familiar, for it appeared first in 1928 and was republished in enlarged form two years later. The exhaustion of the stock made the preparation of a third edition imperative, and the occasion was seized to make many additions. At the same time a thinner paper was adopted, so that the present volume is no thicker than before. There is so much new matter, a third as much again as in the second edition, that we cannot attempt even to give a summary of it, but we may mention that there are many references to work done as recently as 1931 and several to reports and papers published only this year. The valuable plan of printing on one side only so that every opposite page is a blank on which notes may be written has been retained. If we have any quarrel with a reference book which we have found invaluable, it is that the title does not prepare one for the contents, for it might almost be said that only the last 100 pages or so are strictly devoted to fuels. It seems rather censorious to include "Refractories" under the general title, and the useful section on "Metal and Alloys" is but remotely connected with the prime subject through temperature effects. We wonder, too, why the International Steam Tables and the Properties of Saturated Vapours should be hidden behind a title that does not suggest their existence in the volume. Whilst we know the danger of changing the name of an already familiar work, we fear that if the next edition should go even further than the present, the sponsors will have to make application for a deed-poll.

BOOKS RECEIVED.

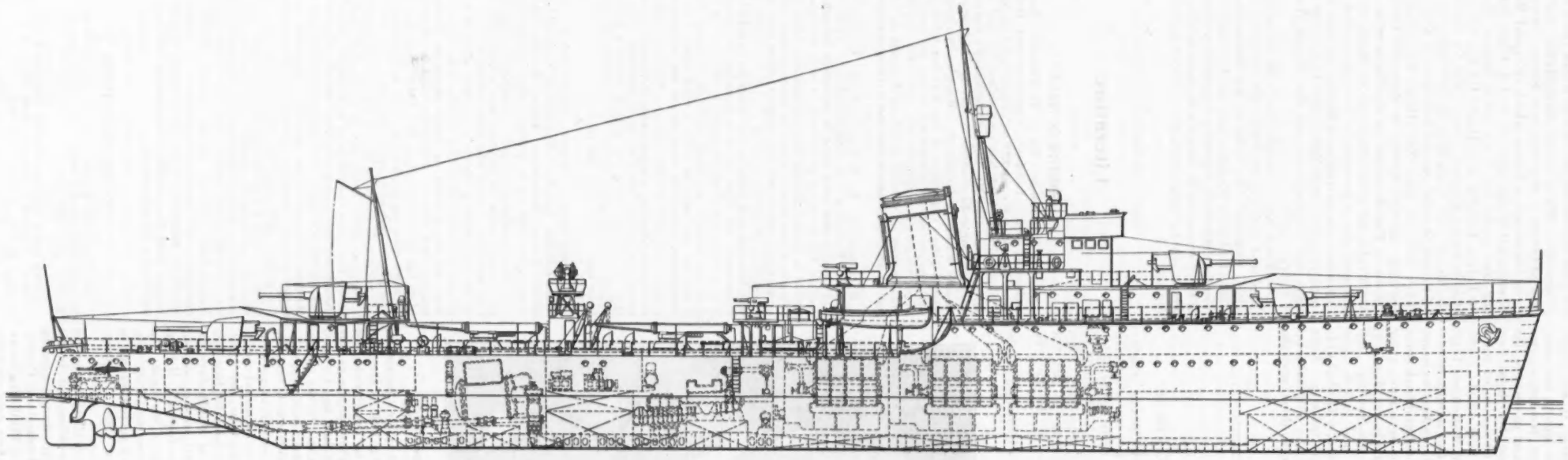
The Two-cycle Engine. By C. F. Caunter. London: Sir Isaac Pitman and Sons, Ltd., Parker-street, Kingsway, W.C.2. Price 15s. net.

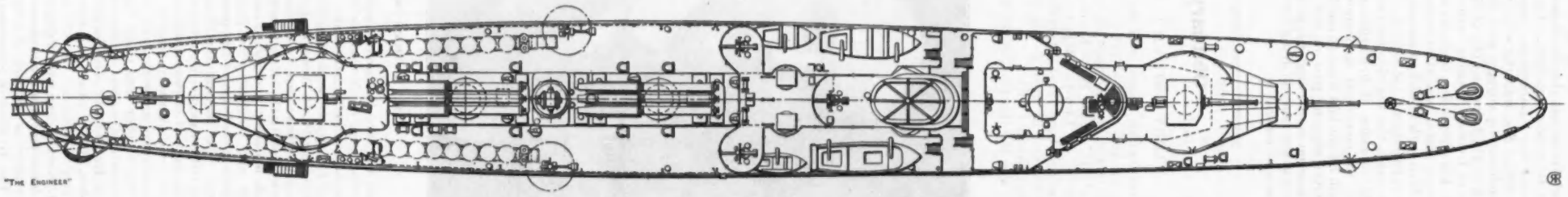
Compression Ignition Engines for Road Vehicles. Second edition. London: Temple Press, Ltd., 5–15, Rosebery-avenue, E.C.1. Price 2s. 6d. net.

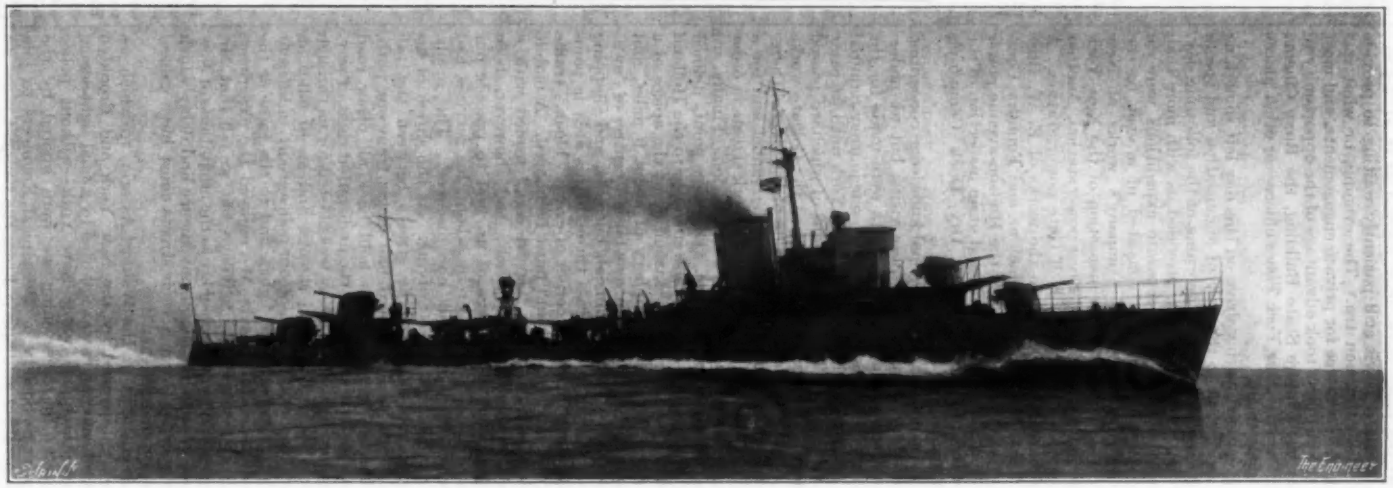
Telephony: Volume I., Manual Switching Systems and Line Plant. Second edition. By T. E. Herbert, M.I.E.E., and W. S. Proctor, A.M.I.E.E. London: Sir Isaac Pitman and Sons, Ltd., Parker-street, Kingsway, W.C.2. Price 20s. net.

DESTROYER FOR THE GREEK NAVY

SOCIETA ODERO - TERNI - ORLANDO, GENOA, BUILDERS AND ENGINEERS







Hull Dimensions.

Overall length	95·24 *m.*
Length B.P.	94·15 *m.*
Breadth	9·73 *m.*
Mean draught	3·13 *m.*
Normal displacement	1445 *metric tons*

Armament.

Main	*Four* 120 *mm. guns*
Light	*Four* 40 *mm. A.A. pompoms*
Torpedo tubes	*Six* 533 *mm., in triple mounts*

Propelling Machinery.

Type : Twin-screw Parsons single-reduction geared turbines.

Designed output	40,000 *S.H.P.*
Boilers	*Three tri-drum, Yarrow type*
Working pressure	341 *lb. per sq. inch*
Degree of superheat	108 *deg. Fah.*
Mean trial output	47,000 *S.H.P.*
Maximum output	52,000 *S.H.P.*
Mean speed on trial	41 *knots*
Maximum speed on trial	42 *knots*
Radius of action	5000 *miles*

Italian Built Destroyers for the Greek Navy.

On page 412 we illustrate one of the four new Greek destroyers, named "Admiral Countouriotis," "Ydra," "Spetzai," and "Psara," which were recently completed by the Società Odero-Terni-Orlando, of Genoa, for the Greek Navy. It may be recalled that the order for these ships was placed in Italy in the autumn of 1929 and work was begun in 1930, the order being placed with the Italian builders after severe competition and the careful consideration of tenders from the shipyards of all the principal maritime countries. The destroyers were built at the company's Sestri shipyards, at which two river gunboats were recently completed for Paraguay, and where the Argentine cruiser "Almirante Brown," a sister ship to the Leghorn-built cruiser "XXV De Mayo," was also constructed.

The principal features embodied in the design are indicated in the elevation and plan drawings reproduced on page 412, with a view of one of the ships, and the main hull dimensions and propelling machinery particulars.

Hull Design and Armament.

The hull is divided into thirteen transverse, water-tight bulkheads, which are carried up to the deck level. The two turbine units and the three boilers are each placed in a separate room, an arrangement which ensures the floatability and stability of the ship, even although extensive damage may have been sustained. The structure of the hull is framed on the transverse system, and high tensile steel has been employed, with an aluminium alloy and duralumin for the bridge. These materials, together with the adoption of electric welding for certain details, have enabled the builders to achieve considerable economies in hull weight, with a gain in metacentric height, both important factors of considerable importance in the construction of ships of this particular class. The breadth of the ship, 9·73 m., or about 31ft. 11⅓in., is greater than that of similar vessels, and the stability has, we learned, proved quite satisfactory with a metacentric height even greater than that fixed by the contract.

The main armament, the position of which is indicated in the drawing, comprises four single 4·7in. guns, equipped

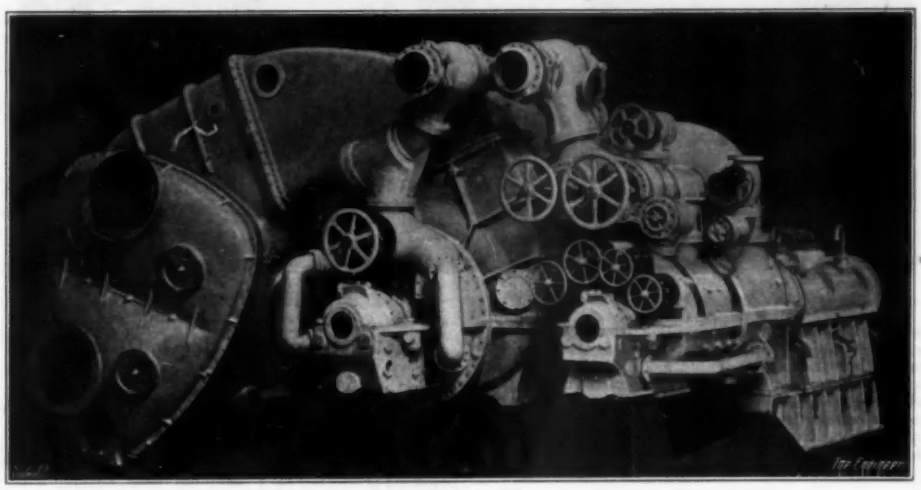


Fig. 1—Model of Turbine Unit for Greek Destroyer

with a Vickers fire-director, while the lighter armament includes four 40 mm. anti-aircraft pom-pom guns. There are also six 21in. torpedo tubes carried in two triple mountings. The guns were all constructed by the Odero-Terni-Orlando Company at its armament works at La

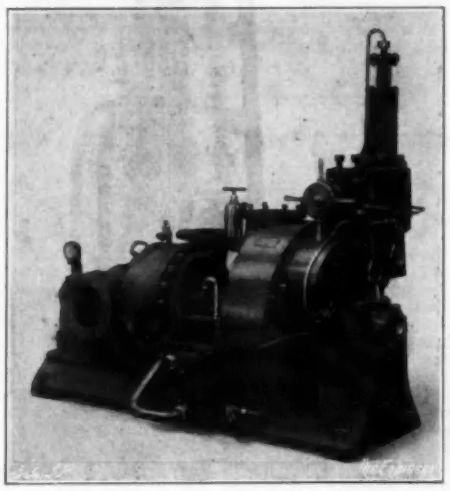


Fig. 2—Feed Pump

Spezia. The ships are equipped with the latest gyro-compass system, two Sperry and two Anschütz instruments being carried.

Propelling Machinery.

The propelling machinery comprises a twin-screw arrangement of Parsons single-reduction geared turbines, the two units being placed one forward of the other, with an intermediate compartment divided into two portions, the upper housing the generator plant and the lower some of the fuel oil tanks. A view of the model of one of the

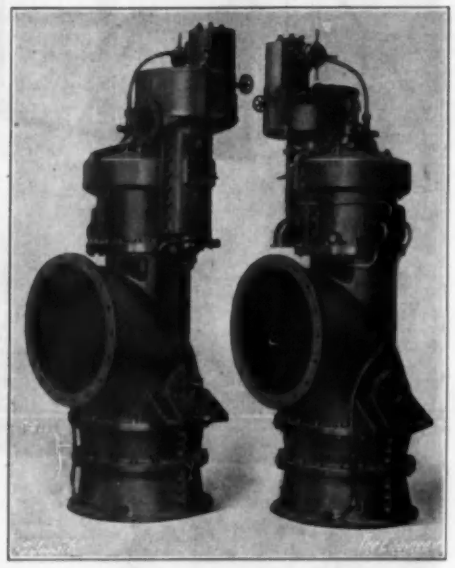


Fig. 3—Circulating Pumps

turbine units is reproduced in Fig. 1. The turbines and boilers, together with some auxiliary pumps, were all constructed at the company's Sestri yards. The boilers, which have superheaters, are of the standard tri-drum modified Yarrow pattern used in the Italian Navy. The tubes enter the drums radially, and the superheater, which is placed outside the generating tubes, consists of a separate drum, into which U-tube elements are expanded. As the drawing shows, the three boiler uptakes are led into a single funnel, a feature first adopted by the Cantieri di Sestri on the "Dardo" class of destroyers built for the Italian Navy. The boilers have each the following dimensions:—Heating surface, 1005 square metres (10,818 square feet); superheating surface, 177 square metres (1905 square feet); or a total of 1182 square metres (12,723 square feet). There are twelve burners, and the working steam pressure is 24 kilos. per square centimetre gauge, or 341 lb. per square inch, with 60 deg. Cent., or 108 deg. Fah., temperature of superheat. The electric generating plant comprises two 50-kW D.C., 110-volt, turbine-driven sets by the Franco Tosi Company, of Legnano, along with two motor-driven dynamos of 18-kW capacity, built by the San Giorgio Company, of Genoa Sestri. There are three main fuel oil pumps for high-power service, and one auxiliary pump of the Weir "Simplex" pattern for cruising purposes. The main fuel pumps are of the Rade volumetric type, and were constructed under a Rateau licence at the builders' Leghorn yard. Each pump is driven by a two-stage turbine through single-reduction gearing, and has a designed output of 14 tons of fuel per hour, delivered at a pressure of 20 kilos. per square centimetre (285 lb. per square inch), when running at 440 r.p.m., corresponding to a turbine speed of 3960 r.p.m. The trials showed that the pressure of fuel could be maintained practically constant, and that the regulation of combustion was very easily carried out with satisfactory results. Other interesting pumps constructed by the builders at Sestri are the main feed pumps and the circulating pumps. The main feed pumps—see Fig. 2—are of the turbine-driven "Odero" type. The pump is a single-stage unit, and is driven direct by an impulse turbine with two velocity stages. It has a designed duty of 180 tons of feed water per hour, delivered against a pressure of 29 kilos. per square centimetre (415 lb. per square inch) when running at 4500 r.p.m. As the engraving indicates, the usual safety and pressure control governors are fitted, also a lubricating oil cooler. The circulating pumps—see Fig. 3—are of the "Odero" axial flow type. The impeller is driven through a single reduction gearing by an impulse turbine with two velocity stages. The design, which includes fixed vanes at the inlet and discharge ends of the impeller, is carried out in accordance with the "Cita" patent. As our illustration shows, the pump occupies very small floor space, and the general lay-out of it and the water piping is very compact. The circulating pumps weigh about 1800 kilos., or about 1¾ tons, each. Each pump has a designed capacity of 6000 tons of water per hour, delivered against a pressure head of 7 m., or about 23ft., when running at 1200 r.p.m., corresponding to a turbine speed of 8000 r.p.m. The pump and turbine shafts are both fitted with thrust bearings, and the design includes the provision of a lubricating oil pump and oil cooler, with the usual governor controls. Other auxiliary plant includes a distilling plant for boilers and domestic uses.

Some Trial Results.

As already mentioned, the propelling machinery was designed for an output of 40,000 S.H.P. On the official trial a mean power of 47,000 S.H.P. was developed. The contract full speed was 39·15 knots, but with all armament and with a displacement greater than that fixed by the contract, a mean speed of over 41 knots was maintained over a period of four hours. As speed measurements during this period indicated values of over 41·8 knots, it may be assumed that speeds of over 42 knots were attained, with a maximum power output of 52,000 S.H.P. The consumption trials were run at a speed of 20 knots, and showed that the vessels have a radius of action of more than 5000 miles. During the gunnery trials, when the whole of the armament was in action, no structural defect of any kind was revealed. Trials were also carried out with the object of verifying the stability of the vessel with various rudder angles at different speeds and the inclinations which were obtained.

An Insulation and Continuity Tester.

In modern electrical installations where steel conduit, lead sheathed or armoured cable is used, the adequate bonding of the metal covering is a matter of great importance. The provision of a continuous and low-resistance earthing conductor in this way has, in fact, become almost as important as high insulation resistance, and the I.E.E. rules now specify that the resistance of the sheathing from any point in the installation to the main switch shall not exceed 2 ohms. Since 1893, when Mr. Evershed, of Evershed and Vignoles, Ltd., introduced the first direct reading insulation testing set, engineers have been able to measure insulation resistance in a convenient way. With the "Bridge-Megger," or "Bridge-Meg," testing sets both the insulation resistance and the conductor resistance of a protective sheathing can be measured. Realising the need for a direct reading instrument, specially suitable for installation work, however, the company has developed the "Meg" insulation and continuity tester shown in the accompanying illustration. With this instrument both insulation and continuity

Insulation and Continuity Tester

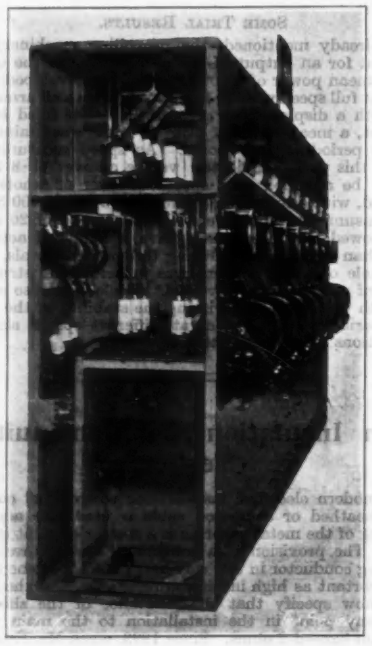
tests can readily be made; the change-over from one test to the other being effected by a simple switch. The instrument is supplied with or without a constant-pressure device on the generator, and to develop 100, 250 or 500 volts.

Two scales are provided on the single dial and the appropriate scale is read according to the position of the switch. While the continuity scale of the 500-volt instrument reads up to 100 ohms, the first half of this scale enables resistances up to 2 ohms to be measured in fractions of an ohm, this being the important portion of the scale for continuity tests. A feature worthy of note is that on either insulation or continuity tests the position of the pointer will be in the upper portion of the scale if the conditions are satisfactory. In other words, the continuity will be 2 ohms, or less, while the insulation resistance will be 1 megohm or more.

The test for continuity, which is carried out at a pressure of a few volts, is made by connecting a low resistance lead to each of the two terminals of the instrument, whilst the other ends of the leads are connected to the conduit or sheathing at the two points between which it is desired to make a measurement, care being taken to make good contact. A reading is then taken while turning the handle of the instrument at about 160 r.p.m. The value obtained naturally includes the resistance of the leads, which must be subtracted, and if this resistance is not known, it may be measured by means of the instrument.

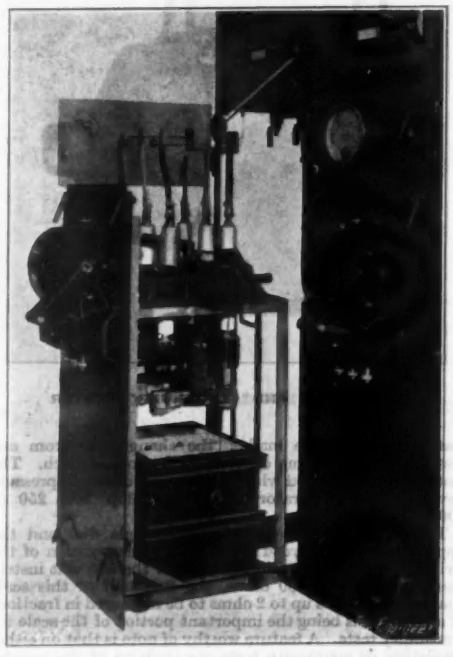
Sub-station Switchgear.

Switchgear suitable for limited spaces and providing complete accessibility to the oil switch current transformers and cable box has been introduced by Crompton, Parkinson, Ltd., of Chelmsford. The apparatus illustrated was designed for use in a sub-station of insufficient depth for the usual design of truck gear and where ordinary cubicle pattern gear of the fixed type had to be rejected on account of the fact that proper examination of the oil switch, access to the cable box and current transformers would have been impossible owing to the limitations



Switchboard with End Plate Removed

of front access alone. The first picture shows a complete board with cable box, current transformer, oil switch, isolators, and bus-bar panel in position, but with the end plate removed for inspection of the interior. The second illustration shows a side view of a single-switch element only, drawn forward for cleaning and inspection. In order to carry out this operation the circuit is first broken by the oil switch in the usual way, when the isolators are opened by means of the long handle projecting in front of the cubicle and which is removable when not in use. The steel plate carrying the ammeter can then be unlatched and swung open on its hinges, the ammeter



Switch Element Drawn Forward

leads being carried close to the hinge so as to reduce their movement to a minimum. Clear access can then be obtained to the vertical links forming the main connections to the switch. The links can be unbolted and the switch truck unlatched and drawn forward on the rollers and axles in the base of the framework.

The entire arrangement is completely interlocked and it is impossible to open the isolators unless the circuit is already broken by the oil switch. Protection against the entry of vermin is assured by a totally enclosed escutcheon, and the method adopted for operating the isolators from outside. The apparatus is claimed to offer all the amenities of standard truck type gear, in addition to the advantages accruing from the saving of space. The illustrations show bus-bar isolators only, it being presumed that the cable feeds a separate circuit which becomes dead on opening the oil switch. It is, however, quite possible to provide feeder isolators in a compartment at the back of the cubicles, but accessible by the removal of screens, the advantages of space saving still being retained.

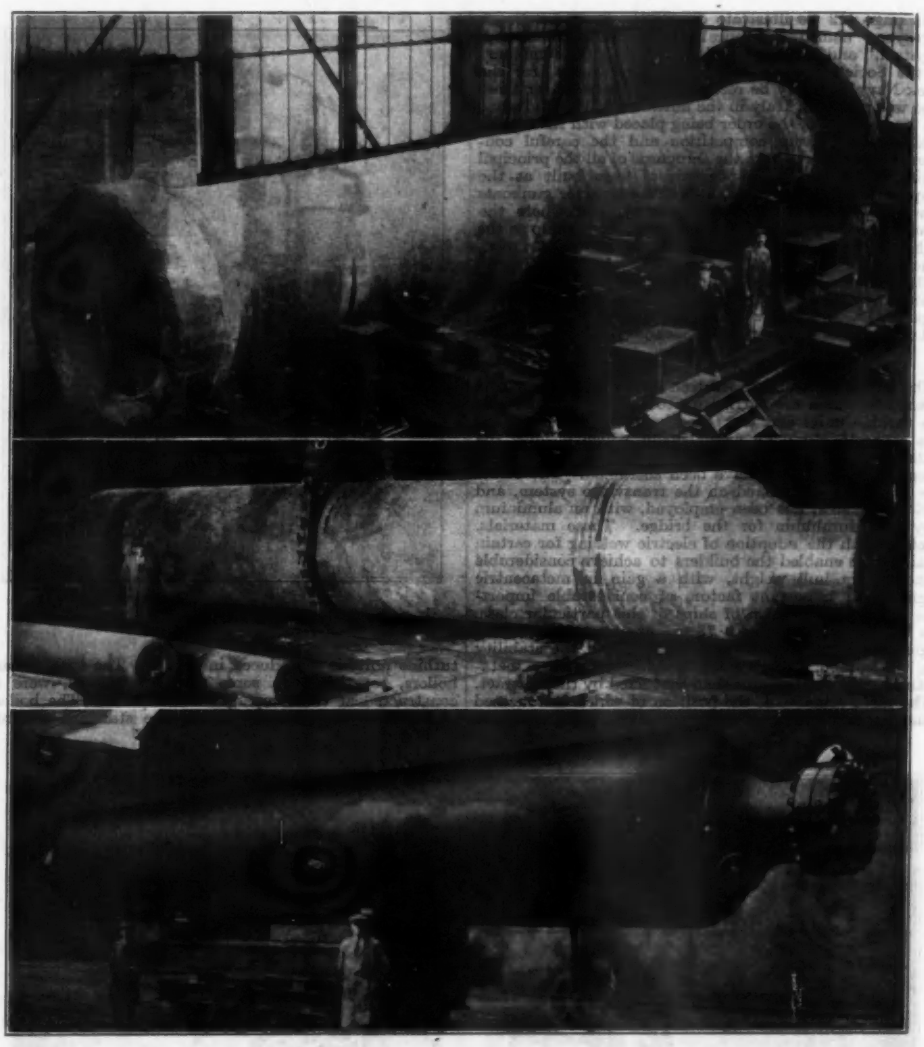
A Very Large Hollow Forging.

We illustrate above what is claimed by the makers, Thos. Firth and John Brown, Ltd., of Sheffield, to be the world's largest hollow forging. The finished article is a reaction chamber for use with the Dubbs cracking unit, owned by Trinidad Leaseholds, Ltd., of London. At the initial stage an ingot of 170 tons was cast at the Atlas Works of the company from three open-hearth acid furnaces. After being worked under the 6000 tons forging press, the ingot was taken to the heavy machine shops, where a 25¾in. hole was trepanned through it. The trepanned ingot was then expanded in diameter under the 6000 tons press, and the drawing process then begun. During this process the mandrel used, together with the balance weights and the chamber in its rough state, weighed 326 tons. In due course the open-ended forging was put into an 82in. centre lathe, and then transferred to a 48in. lathe with a 70ft. bed, where it was bored for its entire length. As an indication of the accuracy of the forging operations, it may be mentioned that the finished bore was machined to 71½in. from a forging which measured 69¼in. internal diameter. In other words, ¾in. of material alone had to be removed.

In the initial forging operations "swells" had been left at each end of the chamber. These ends were subsequently closed under the 6000 tons forging press to the required shape. The next stage consisted of heat treatment in one of the furnaces which the firm has developed for this class of work. The uniformity of the material in the ingot was demonstrated by the fact that test results taken from the bottom and top of the extreme ends showed a difference of only half a ton per square inch in the maximum stress. The final machining in a 50in. lathe, together with the drilling of twenty bolt holes in each end flange, completed the engineering operations.

The finished reaction chamber has an overall length of just over 48ft., an outside diameter of 78¾in., and an inside diameter of 71½in. Its approximate weight is 66 tons. In the accompanying engraving the upper view shows the forging before the ends were closed, the second view illustrates it with the ends closed, ready for external machining, and the third view shows the finished chamber.

VERY LARGE HOLLOW FORGING



An Automatic Rod Polishing Machine.

The machine which we illustrate herewith, by W. Canning and Co., Ltd., of 133, Great Hampton-street, Birmingham, is intended for the automatic polishing of rods of any material up to 2in. in diameter. The polishing is effected by a band, 6in. wide, covered with an

Rod Polishing Machine

abrasive suitable to the work in hand. This band runs over two pulleys, one above the other, the lower one of which is driven by an electric motor. The upper one is provided with a tension adjustment. A second band runs inside the abrasive band over a separate lower tension pulley, and forms a supporting cushion to the abrasive band. The rod to be polished is fed forward on a table by another short band passing round two pulleys, which

is set at a slight angle to the vertical, so that it not only feeds the rod, but also rotates it. The angularity of the feed belt can be adjusted to give any rate of feed from 10ft. to 20ft. per minute. The driving shaft runs at 1400 revolutions per minute and requires about 10 horse-power.

South African Engineering Notes.

(By our South African Correspondent.)

Large Crane for Durban.

The arrival of an 80-ton crane, which will cost the Government £26,000, erected, marks another stage in the process of making Durban Harbour as up to date as any in the world. Several of the eleven 4-ton cranes, which were ordered to replace the hydraulic cranes which have been in work for many years, are now in service, and the 12-ton electric crane has been erected. Two 4-ton portal cranes for the Congella portion of the harbour area are due this month (September), and the 25-ton self-propelling floating crane is stated to have left the Clyde. When Durban's new 80-ton crane is erected it will provide the port with the largest crane in South Africa, the biggest at present being the 60-ton floating crane at Cape Town. Durban has a 50-ton hydraulic crane, but this is to be dismantled. East London has a 50-ton electric crane. The cost of all the new cranes being supplied to Durban is estimated at £115,000.

Vereeniging Electricity Plant.

Members of the South African Institute of Engineers who paid a visit to the Vereeniging power station of the Victoria Falls and Transvaal Power Company, Ltd., sometime back had an opportunity of seeing a Metropolitan-Vickers two-cylinder tandem impulse turbine generator in course of construction. One machine of this type and size has been at work for about a year and has given excellent service. The capacity is 32,500-kW maximum continuous rating, the generator being 40,000 kVA, wound for 10,500 volts between phases, and it rotates at 3000–3100 revolutions per minute. The low-pressure cylinder is designed with the well-known Baumann multi-exhaust. The exhaust end of the condenser is what is known as a central flow type, in which all the steam is collected into a space in the centre of the condenser, with the result that the condensate which is removed at the bottom of the condenser is at virtually the vacuum temperature. The maximum periphery velocity of the blades is 890ft. per second, and the length of blades in the last row 14½in. The mean blade speed of the last row is 685ft. per second when running at 3300 revolutions per minute. The steam conditions are 200 lb. per square inch gauge at the stop valve, with a normal steam temperature of 330 deg. Cent. The circulating water inlet temperature is taken at 22·5 deg. normal, and the steam consumption, including steam to ejector and condensate heater, but excluding steam to other auxiliaries, and assuming that no steam is being taken for pressure feed heating, is guaranteed to be 11·2 lb. at full load of 32,500 kW and 11·08 lb. at 30,000 kW—the most economic load. The condenser has a cooling surface of 36,500 square feet, and the amount of cooling water required for the condenser is normally 1,600,000 gallons per hour, against a total head of about 63ft. The circulating pump delivers about 2,260,000 gallons per hour, the balance being taken by the air coolers, generator, air cooler, &c. The circulating pump absorbs 520 kW, the extraction pump 50 kW, and the generator, ventilating fans, of which there are two, 92 kW each. The first-mentioned unit of this type has been running for about twelve months; another unit is in course of erection, and a third machine is on order, and will be erected at the other end of the station towards the end of this year. In addition, the visitors noticed the single-cylinder, 20,000-kW Parsons turbine generator, the outstanding feature of which is that the turbine is used in conjunction with the condenser supplied by the A.E.G., with its 10,000-kW machine, which was dismantled and removed to make room for the 20,000-kW machine. At the present time the station uses 50,000 tons of coal per month, which, of course, will be vastly exceeded when the four new boiler units now being installed are at work. These boilers are to give a maximum continuous output of 180,000 lb. per hour. Each boiler will burn 15 tons of coal per hour.

THE JUNIOR INSTITUTION OF ENGINEERS.

In his address as Chairman of the Junior Institution of Engineers, delivered on Friday, October 14th, Mr. J. Foster Petree, A.M.I. Mech. E., A.M.I.N.A., stated it had long been realised that a knowledge of engineering matters alone is not sufficient even for the proper conduct of engineering enterprises. An engineer must have knowledge of what are called the economics of engineering, and be fitted to take a more active part in the management of that civilisation which he has helped so largely to create, and which he alone can maintain. The quantity of technical knowledge that the engineer must assimilate only to maintain his position amongst his fellow engineers is steadily increasing, and it becomes more and more difficult for him to snatch a respite from the technicalities in order to take his proper place as a human being amongst other human beings. Yet, until he does take that place, qualified for it by a really liberal education and outlook, engineering will probably continue in its present unsatisfactory position, something less than a learned profession in social standing, something more than a skilled occupation in the intellectual standard demanded of its practitioners, lacking much of the dignity appertaining to the law and to medicine, and lacking still more their financial potentialities and their security of tenure.

The extraneous knowledge referred to may roughly be divided into four main classes: (*a*) Economic principles which every producer should know, and of which most ordinarily observant individuals have some acquaintance; (*b*) administrative knowledge to appreciate the operations involved in commercial design, production and distribution; (*c*) knowledge requisite to equip a director or executive head of an engineering undertaking, such as factors influencing works' location and lay-out, the migration of labour, questions of law and insurance, the study of markets and their tendencies, the effect of political situations and the lessons of history and their application to his own industry and circumstances; and (*d*) general knowledge and the ability not merely to store facts, but to use them in some entirely new combination. The address proceeded to enlarge upon the matter under these heads and added a warning that management is, after all, only a means to an end, and not the end in itself. The super engineer must still attend to his engineering.

Provincial Letters.

THE MIDLANDS AND STAFFORDSHIRE.

(From our own Correspondent.)

Empire Trade Optimism.

Industrialists in the Midlands and Staffordshire welcomed the publication of the schedules of the Ottawa Agreements and their perusal has created a feeling of optimism in many trade circles. The schedules contain numerous and valuable concessions to some local manufacturers, amongst which are the motor cycle and cycle engine producers and the rollers of galvanised sheets. These, amongst others, lost no time in acquainting themselves with the details, and they are intent upon taking the fullest possible advantage of the definite extension of trading opportunities which they provide. Immediate results are not expected, but an early development of trade is confidently looked for. Iron and steel masters doubt whether they will benefit directly as a result of the agreements, and they are not expecting any marked increase in business until the great steel-using industries improve. The big tube firms say there is little to be gained, while the chain trade is doubtful. As a consequence of the Conference the Australian embargo on aluminium products has been lifted, with considerable benefit to Staffordshire and East Worcestershire manufacturers. It is generally agreed that the agreement lays the foundation on which closer economic unity within the Empire may be established and that there appears to be a fairly equitable bargain. Industrialists here are certainly more sanguine as to the future than they would have been without the assistance of Ottawa.

An Engineer's Views.

Sir Herbert Austin, at the annual dinner of the Austin Motor Company, after stating that in spite of all restrictions, the automobile engineering industry has made progress, said:—"At last there are signs of returning confidence in most directions. Our company is experiencing a record demand, and I understand that our competitors in the industry are also enjoying similar conditions. The upward tendency is not confined to this country, but is evident in other parts of the world, especially within the Empire." Further, he said:—"It will readily be admitted, I imagine, that the motor industry is a shining example of what can be achieved by the use of modern machinery and methods, assisted by the confidence that a safeguarding measure provides. If other industries in the country had progressed and modernised their operations to the same extent, I am certain we should have considerably fewer unemployed to-day."

Raw Iron.

Blast-furnacemen in this area continue to gain ground, but the improvement in demand is not such as to warrant any increase in output. Some of the heavy foundries, as well as those engaged on heating equipment and the diversity of light castings in which this district specialises, are using rather more pig iron. In many of the miscellaneous metal-working branches buying is proceeding on less restricted lines, and specifications this week have shown further improvement. Stocks at the Northamptonshire furnaces are large, but in some cases they are now being called upon to meet customers' requirements. Selling values are as laid down by the Central Pig Iron Producers' Association, namely:—Derbyshire No. 3 foundry, £3 6s.; forge, £3 1s.; Northamptonshire No. 3 foundry, £3 2s. 6d.; forge, £2 17s. 6d., all per ton delivered Black Country stations and subject to rebate in the case of large buyers. It is pleasant to find that, taking the kingdom over, the number of furnaces in blast increased last month by two to fifty-nine. The Midlands takes credit for one of these. Production of pig iron in September amounted to 260,400 tons, compared with 259,400 tons in August and 248,200 tons in September, 1931. The production includes 50,900 tons of hematite, 126,600 tons of basic, 69,200 tons of foundry, and 8200 tons of forge pig iron. The raw iron situation certainly has encouraging features and smelters here welcome the brighter outlook.

Steel.

In the heavy steel trade conditions remain very quiet, but there is a little more hopeful news from the shipyards this week, while one or two other steel-consuming trades report slight progress. The constructional establishments and the rolling stock makers, however, can see, at the moment, no prospect of becoming larger users of steel in the immediate future. Those users who had hoped for a reduction in steel prices were again disappointed, for the Steel Manufacturers' Association, after reviewing the situation, announced that the basis prices and rebates would remain where they have stood for nearly two years. Midland rates are:—Angles, £8 7s. 6d., less rebate 15s.; tees, £9 7s. 6d., less rebate 15s.; ship, bridge, and tank plates, £8 17s. 6d., less rebate 15s.; joists, £8 15s., less rebate £1 2s. 6d. Practically all the consumers in the Midlands have contracted to use the British material and consequently come under the rebate scheme. Market conditions have been very quiet of late and the reaffirming of selling rates had no appreciable effect upon the market. Prices of boiler plates, which are not controlled, are stationary at £8 7s. 6d. to £8 10s. per ton. The hopeful tone is maintained in the market for semi-finished steel, since billets and sheet bars are now but a few shillings dearer than the Continental equivalents. Many of the foreign makers have withdrawn from the market and business would undoubtedly be much better for local steel masters were it not for the large stocks of foreign steel in works yards. There being no urgency of demand, producers do not see the necessity for making price alterations at the moment, and these continue as a week ago. Small steel bars re-rolled from Belgian billets are quoted £6 7s. 6d. upwards, and all-British bars £7. Mild steel billets are £4 17s. 6d. to £5 7s. 6d. and sheet bars £4 15s. upwards.

Staffordshire Iron.

The condition of the South Staffordshire wrought iron trade has undergone no important change on the week. Makers of marked bars adhere to a quotation of £12 a ton at the works, on which basis one or two firms claim to be reasonably active. Crown bar mills are working on short time and sales are few and of small content. Prices vary from £9 to £9 15s. Common bars are in poor request, makers of bolts and nuts and of fencing having ample supplies of Continental material at their disposal. Prices range from £7 15s. to £8. Iron strip costs £10 7s. 6d. to £10 10s. delivered, though producers are of opinion that operations are unprofitable at this level. They could handle much more business than is available at present and in some instances they prefer to keep the mills going even though there is little or no return from them. Makers are expecting an early expansion of demand and a return to more profitable production. Ironmasters generally have no greater reserve of orders than was the case three months ago, and last week's quarterly meeting produced little new business to augment order books.

Galvanised Sheets.

Galvanised and black sheets for the home trade are to be quoted on a delivered basis in future instead of f.o.t. Makers having come to this decision, have revised selling prices. For 24-gauge galvanised the price is now £11, and for similar black sheets £9 carriage paid. There is no change in the quotation for export business. Merchants are inclined to be critical about the rearrangement. There is still a certain amount of underselling by middlemen who made contracts before the upward movement gained strength. It is not sufficient, however, to interfere seriously with business. Overseas demand for sheets has gained further ground and some useful orders have recently come to makers in this area. Consequently the mills are more regularly employed.

LANCASHIRE.

(From our own Correspondents.)

Manchester.

Textile Machinery Exports.

Overseas trade in textile machinery last month experienced a setback compared with the corresponding period of last year, September incidentally being the first month this year to fail to record an improvement on the 1931 returns. This setback, however, may prove to be but a temporary halt in the upward trend of the export business in textile machinery, which has been in evidence since the beginning of 1932. Last month's total shipments amounted to 4051 tons, valued at £364,863, against 5154 tons and £440,711 in September of last year, and included 2717 tons of spinning and twisting machinery, valued at £251,449, and 1078 tons of weaving machinery, valued at £77,231. Exports during the month to British India, Australia, and South American countries showed some measure of improvement, but to all other markets shipments were on a smaller scale. Poor as have been the exports to Russia during the past year or so, September is the first occasion on which no shipments at all have been made. India continues to occupy first place as a market, exports thence during the period under review reaching an aggregate value of £135,331. China was second with shipments valued at £33,318, followed by Australia with £19,482, South America £19,017, France £18,196, Germany £10,544, the Netherlands £9649, Japan £6464, and the United States £5400, exports to "other European countries" being valued at £61,991. In spite of the September setback, exports during the first nine months of the year represent a substantial improvement compared with the January–September period of 1931, the respective totals being 47,801 tons and £4,178,739, and 38,779 tons and £3,867,402.

An Offer from the Combine.

For some weeks now rumours have been current in the Manchester district of "conversations" between the directors of Textile Machinery Makers, Ltd., which has been in active existence for a little more than a year, and Tweedales and Smalley, Ltd., of Castleton, near Rochdale, with a view to the purchase of the latter's business. Messrs. Tweedales and Smalley have naturally suffered from the prevailing conditions, but the fact that the directors have just declared an interim dividend of 2½ per cent. points to a definite improvement so far as the position of the company itself is concerned, for in the previous year there was no distribution on the ordinary share capital. It is understood that they have orders on the books which will keep the plant working at fair capacity for several months. A meeting of shareholders of the company to consider the offer of Textile Machinery Makers will be held later in the month. Whether it will be accepted is problematical. The directors of Messrs. Tweedales and Smalley are believed to be divided on the question of acceptance, with an important section, including the chairman, opposed to the company ceasing its independent existence.

Manchester Association of Engineers.

At the opening meeting of the session of the Manchester Association of Engineers last Friday, the

"Constantine" Gold Medal was presented to Mr. G. R. Adamson for his paper on "The Waste Heat Boiler and its Effects on Furnace Design, Operation, and Output," and the "Butterworth" Gold Medal to Mr. C. E. Stromeyer for contributions to the discussions during the previous session.

Non-ferrous Metals.

The movements of the non-ferrous metals during the past week have been irregular. A relatively important advance in prices in the tin section has been a prominent feature of business, but, on the other hand, further slight easiness in copper and spelter and a more substantial fall in lead has occurred. At time fairly heavy buying of tin has been in evidence and this, coupled with prospects of a tightening up of the statistical position of the metal, has brought current values to a higher level than they have been at any time during the recent upward movement, the rise on balance for the week being in the region of £4 per ton. On the whole, the demand for copper has been on a limited scale, and with few supporting features, the market has been easy, although compared with a week ago prices are not more than about 2s. 6d. per ton lower in the case of standard brands. In lead also sales have been by no means extensive, and prices in this section, through the week's loss of about 10s. per ton, are almost back to where they were in mid-August before the last advance set in. Spelter has declined by a shilling or two on balance for the week, with inquiry from most directions restricted.

Iron and Steel.

Business on the iron and steel markets this week has been generally quiet, although recent business or prospective new business in the constructional engineering and locomotive building branches holds out the hope of the steel tonnage expanding in these directions. At the moment, however, inquiry continues on the same quiet scale that has recently been ruling. In certain cases a fair volume of work is in hand in the bright steel departments, but the demand for most other classes of bars is poor. Iron and steel forgings are also in quiet demand. Sellers of imported materials are steadily raising their quotations, and as each advance in price means an increase in the amount of duty to be borne, the margin in favour of foreign products is a gradually diminishing one. There has been no apparent improvement so far in the demand for foundry pig iron, and only odd forward contracts are coming on to the market. On the whole, however, the aggregate tonnage going into consumption locally is maintained at about its recent level, and an encouraging factor this week from the point of view of the pig iron maker has been the tendency of scrap material to harden in price. For delivery to users in the Manchester district Derbyshire and Staffordshire No. 3 are maintained at 67s. per ton, Northants at 65s. 6d., Derbyshire forge at 62s., Scottish foundry at about 84s., and West Coast hematite at about 81s.

Machine Tool Demonstration.

A special demonstration of a number of machine tools which are recent developments of manufacturers represented by E. H. Jones (Machine Tools), Ltd., of London, is to be held at the New Cross Garage, 43–45, Oldham-road, Manchester, from October 26th to November 3rd. The machines to be shown include the following:—Thiel duplex super universal tool and punch milling machine, Thiel vertical punch and form shaping machine, Thiel production tapping machine, Thiel high-speed metal bandsawing machine, Thiel precision filing and sawing machine, Saalfeld automatic drilling machine with automatically operated indexing table, Saalfeld high-speed drilling machine units, Rapidia wire stripping machine, and Werner "Microlux" mirror comparator. So far as is practicable, visitors' own work will be demonstrated on the machines.

BARROW-IN-FURNESS.

Hematite.

Up to the present there has been no further improvement in the hematite pig iron market, and there is still a lack of confidence on the part of buyers. If buyers are waiting for a further reduction in the price of iron, they are likely to wait in vain, for there is no margin of profit at present prices, and it is hardly likely that makers, situated as they are, will sell iron at a loss. Business is mostly confined to home demands, and there is very ltitle iron being sold abroad at present, either to the Continent or to America. There have been rumours that more furnaces were to be put in blast, but up to the present there are no signs of preparation, which means that present stocks have got to come down further before the producers increase their output. The iron ore trade is still quiet, for quite apart from the small demand locally, there is not much business with makers outside the district. Foreign ore is coming in slowly. The steel market continues to be dull, and there are not many orders about, and there is keen competition for such as come into the market.

Shipbuilding and Engineering.

Barrow, so far as shipbuilding and engineering is concerned, is in better circumstances than many other similar districts in this country, as is proved by the fact that over 9000 hands are employed by Vickers-Armstrongs locally. What is more, this number is likely to be employed through the winter. There is no news of further orders at present, but the outlook is not as bleak in this district as in others. It is possible that further orders may be secured, but at the present time no official information is obtainable.

SHEFFIELD.

(From our own Correspondent.)

Steel Trade Conditions.

The week has produced no material change in local iron and steel trade conditions, and both output and turnover remain in the same position as for some time past. Unemployment figures are still in the neighbourhood of 60,000, and there are pessimists who declare that this alarming total will show no reduction for some time. The steel duties expire on October 26th, and it is anticipated that they will be renewed for an extended period. It is understood that the Import Duties Advisory Committee has been urged from several quarters to prohibit the imports of foreign steel, or at least certain kinds of steel. When the matter is again discussed, some information will probably be forthcoming of the work of the Committee on iron and steel which has been formulating plans for the reorganisation of the industry. Business remains poor in the steel scrap market. Prices for basic quality offered by users continue to decline, but sellers insist on 34s. as the real market value—an abnormally low figure in relation to the value of new materials.

Decline in Exports.

Exports of iron and steel material in September were only 127,039 tons, or 30,000 tons less than in August and 73,000 tons less than in September last year. The loss over the nine months is 51,000 tons on last year, but the total is 1,100,000 tons less than in 1930. On the month there were losses in pig iron, bar iron, unclassified steels, special steels, hoops and strips, steel plates, and sheets of all kinds, and wrought tubes. Small gains are recorded in wire and railway wheels, cast pipes, and special steels. Imports were practically the same in tonnage as in August, and there was an insignificant gain on the nine months. A feature of the returns continues to be the slump in imported special steels—tool steels, alloy, and stainless steels. These constituted a heavy item until a tariff was levied on foreign steel, but in recent months the imports have declined nearly two-thirds. A considerable proportion of the imported alloy steels went to several of the large motor building works in this country, but most of the trade has now been transferred to Sheffield. The outstanding feature of the cutlery returns for September is the substantial increase of trade with Australia and Canada, though apart from these items the cutlery trade is still losing ground in overseas markets. Imports of cutlery show a marked decline.

Production of Magnets.

A branch of industry which is booming at present and has been for some time, with great prospects for the future, is the manufacture of steel magnets, on which considerable research has been carried out. Whereas the best magnets formerly came from abroad, the best magnets in the world are now manufactured in England and exported to all countries. Thousands of magnets are made in Sheffield every week. The wireless industry, in particular, has brought considerable work to Sheffield in the production of permanent magnets.

Sheffield and Ottawa.

Details of the agreements signed at Ottawa show that Canada is to be a free market for Sheffield tool steels and other steel in bars, with a substantial duty on foreign goods. Needless to say, this fact has caused immense satisfaction among local steel manufacturers, and their jubilation is shared by makers of pen and pocket knives, scissors and shears, razors and razor blades, which are to be admitted to the Canadian ports free of duty. The tariff on British hand tools, including saws, hacksaws, and files, is reduced from 20 to 10 per cent. It is felt that the staple industries of Sheffield should take on a fresh lease of life when the United Kingdom–Canada Agreement is given legislative enactment.

Trade from Copenhagen.

The local light trades will benefit to some extent as a result of the Copenhagen Exhibition, which closed last week-end. One firm has booked good orders for special knives of the butcher's type, as well as others. Other firms have brought back nice orders for spoons and forks.

Important Railway Contract.

The well-known Sheffield firm of public works contractors, George Longden and Son, Ltd., has secured a contract for building two new important railway stations, one at Shenfield and the other at Harold Wood, on the southern section of the London and North-Eastern Railway. A big widening scheme is being carried out on the main line between London and Southend, and the two stations are to be completely remodelled and modernised.

Mechanical Coaling Plant.

A new mechanical coaling plant has been brought into use in the locomotive yard of the L.N.E.R. at York, and similar equipment is to be provided in other important yards, including Doncaster, Hull, and Immingham. The new plant at York consists of a ferro-concrete structure, 100ft. high. It sets astride two rows of metals, on which the engines to be refuelled are run, two spouts from the coal hoppers running down to the level of the tops of the tenders. In this way two engines can be coaled at the same time. Alongside the foot of the coaling plant is a line for the full wagons. These are shunted by gravitation on to a table, which is elevated mechanically 75ft. to the top of the bunker, where it is tilted over, emptying into a trough which meets it automatically as it turns. The trough descends into the bunkers until, reaching an obstacle, it is automatically opened, and the coal slides into the bunkers. The empty truck is lowered by the elevator, and by means of gravitation is sent to the reception siding for "empties." The coal is delivered by a belt conveyor through a chute into the tender of the engine.

Water Projects.

The Chapel-en-le-Frith Rural Council is proposing to purchase the water plant of the Castleton Water Company, Ltd. At the recent inquiry into the application for a loan of £2500 for the purpose, opposition was forthcoming, whilst the Ministry of Health's Inspector said he felt that there had been a total lack of evidence of any urgency in the matter, especially in view of the present need for economy. The scheme is for joining the Castleton works mains to the existing Hope scheme. The Driffield Rural Council has decided to proceed with the construction of a borehole so as to provide a water supply for the Wolds village of Foxholes.

Barnsley Mining College.

The new mining and technical college which has been built by the Barnsley Corporation, with the aid of a grant of £15,000 from the Miners' Welfare Fund, is an imposing four-storey building with extensive frontages, and is surrounded on three sides by a wide area. The plan is arranged with a large central court, which is covered in at the ground floor level with roof glazing, thus giving excellent top light to the large central mechanical engineering laboratory. In the basement, accommodation is provided for five laboratories, and on the ground floor are a large examination hall, 66ft. by 33ft., and numerous laboratories and other rooms; whilst on the first floor are various class rooms, lecture rooms, a building laboratory, and drawing lecture rooms. Eight commercial class rooms and laboratories, among other accommodation, are provided on the second floor. In the construction of the building, fireproof materials have been used throughout.

Veteran Mining Engineer's Death.

Mining engineering has lost a well-known figure by the death of Mr. E. W. Thirkell, of Aldwarke, near Rotherham, at the age of seventy-two. He gained his early experience as a mining engineer, surveyor, and valuer at collieries in the Barnsley and Leeds districts. He became manager of John Brown and Co.'s Aldwarke Main and Car House collieries in 1900, and after the latter was closed continued his connection with the Aldwarke Main pit for some time, being later associated with the management of the pits of the Dalton Main Collieries, Ltd., and John Brown and Co., Ltd., in estate and general work. He was a member of the Institute of Mining Engineers and the Institute of Mine Surveyors, among other bodies.

NORTH OF ENGLAND.

(From our own Correspondent.)

Coal Subsidy Proposal.

The Government's scheme for subsidising coal exports is of special interest to such large exporting areas as Northumberland and Durham. The district boards of the coalowners are considering the proposal that there should be a levy on coal sold inland to assist the export side of the industry. Those responsible for the proposal claim that eventually a larger output of coal would result in reduced working costs, equivalent to the amount of the levy. It does not promise to meet with much support in the North of England, however. Indeed, there is to be very strong opposition. The Government's subvention to help miners' wages and exports some years ago is not readily forgotten. It cost the country £23,000,000 without doing any real good. The foreign buyer got the benefit of cheaper coal for a while, but there was no lasting advantage to the mining industry. As it is, the home industries have to pay a relatively high price for their coal, and the same may be said of the railways and electricity and gas undertakings. Therefore all of these are likely to resist stoutly any increase in their fuel bill merely to lower the export price and give the foreign manufacturer an advantage over the home manufacturer. It is the contention of coal exporters in this area that the best thing for reviving the export trade is the establishment of an entirely free market for exports by the abolition of a fixed minimum price and the quota system.

Cleveland Iron Trade.

There is little change of note in the Cleveland pig iron trade. Within a few days the intentions of the Tariff Board in regard to the continuation of the iron and steel import duties must be disclosed, and there is a tendency to suspend business until definite information is available. Nevertheless, the Ottawa schedules are recognised as opening the door of opportunity to the steel trade, and better business is now hopefully expected. Many consumers have yet to complete provision for end-of-year requirements, and trade promises to expand in the near future. Midland and Indian competition for Scottish trade continues keen, with the result that producers of Cleveland iron are granting substantial price concessions to firms across the Tweed. For home trade, No. 1 Cleveland foundry iron is 61s.; No. 3 G.M.B., 58s. 6d.; No. 4 foundry, 57s. 6d.; and No. 4 forge, 57s.

Hematite Pig Iron.

Producers of East Coast hematite pig iron are encumbered with heavy and steadily increasing stocks, but home demand shows some improvement. Merchants hold considerable quantities, and do not hesitate to shade makers' quotations. The latter offer iron on the basis of ordinary mixed numbers at 59s., but this price can be cut for a good order.

Ironmaking Materials.

Foreign ore is not saleable at the moment, although on a freight of 4s. 3d. from Bilbao to the Tees sellers are able to offer best Rubio ore at 14s. 6d. c.i.f. The restricted market for blast-furnace coke keeps prices at an unprofitable figure, and there are ample supplies on offer at 14s. 6d. delivered at the works.

Manufactured Iron and Steel.

There is a moderate flow of specifications for constructional steel, but overseas business has not matured as quickly as had been hoped. The almost complete stoppage of the shipyards is another serious matter for the steel works, and orders for all descriptions of heavy steel are badly needed. In the finished iron trade, too, the demand is disappointing. All quotations are steady.

The Coal Trade.

The Northern coal trade outlook continues to improve, and the greater strength of some sections of the

market is fully maintained. There are not many fresh inquiries circulating at the moment, but recent bookings have been more numerous than for some weeks past, and most of the collieries in Northumberland and Durham are working with greater regularity. There is continued firmness in large steams, best bunkers and best gas coke, with patent cokes and leading gas coals moving on steady lines. The weak spots are coking coals, second-class bunkers, and second-class gas coal. The majority of collieries in Northumberland producing best-class steams are substantially booked for the next few weeks. Another satisfactory feature in Northumberland is that the current output of smalls in most instances is being disposed of, and tipping on the ground has ceased. There is, of course, still about a million tons of smalls unsold. Northumberland best steams are offered sparingly at 14s. for any additional supply for this month or early November. Tyne prime command 13s., and prime Wear quality 15s. to 15s. 1½d. Good secondary steams are steady at 12s. 3d., and smalls are offered at from 8s. 6d. to 9s. On the Durham side, large steams are also finding a good sale and smalls are moving well. Gas coals are getting more trade and the best qualities are favourably placed for the present, with the price firm at 14s. 6d. Secondary are quoted at 13s. 3d. to 13s. 6d. Best bunkers are in a satisfactory position, and some collieries are well booked into November. A few steamers have sailed on long voyages in ballast, there has been more trade for the coaling stations, while further orders are expected, and this combination of circumstances has given strength to the department. Best sorts hold firmly at 14s., and second-class at 13s. Producers of coking coals are still experiencing a poor demand and there are no signs of increased activity in this section. All classes of coke are in a favourable position, except blast-furnace sorts for home use. Gas coke is in a better position than it has been for a long time. There is very little of the best kind to be obtained and the quotation is nominal at 18s. to 18s. 6d. If there were coke for sale it would probably be worth about a shilling per ton more. For patent oven coke of the ordinary class there is a much firmer tone, and 15s. to 15s. 6d. is freely asked. Higher grades are 16s. to 18s. Shipments continue steady in volume. Coke nuts are in request at 16s. to 18s., and more are to be despatched to North American ports.

SCOTLAND.

(From our own Correspondent.)

Shipyard Work.

WHILE nothing in the nature of a revival of the shipbuilding industry is suggested, there has certainly been more inquiry for new tonnage of late, a fair proportion of which is confidently expected to come to the Clyde. Meanwhile, on the Clyde the chief source of employment is repair work. East of Scotland shipbuilders have booked four orders within the past month, the latest of which being a contract booked by the Caledon Shipbuilding and Engineering Company, Ltd., Dundee for a 3500-ton steamer for Australian owners.

Steel.

So far as heavy steel is concerned, there is no improvement to report; in fact, the reverse is rather the case. The amount of business in circulation has decreased of late, and it has become increasingly difficult to keep the mills in operation. Two of the plants have been idle for a week.

Steel Sheets.

The demand for sheets continues to expand. Heavy varieties are slow to respond, but the improvement in light sheets is fully maintained, and the prices of these may be subject to a further advance.

Galvanised Sheets.

The price of galvanised sheets of 24 g. has been fixed at £11 per ton for home delivery, and the export quotation advanced by 15s. per ton to £10 15s. per ton, f.o.b. Glasgow.

Tubes.

Inquiries of considerable importance have been in circulation, but bookings have been on restricted lines to date. In small diameter butt-welded tubes an improvement is recorded, and the works concerned have more regular employment than for some months past.

Iron.

Bar iron and re-rolled steel bars are not making much, if any, headway. The latter still suffer in competition with Continental material. Orders are few and far between, and the mills, as a rule, are working about three days per week. Prices for bar iron are unchanged, and re-rolled steel bars are quoted £6 10s. home fixed and £6 5s. per ton export. The demand for hematite and ordinary pig iron is generally easily met from stocks, and the production is confined to the output from one furnace. During the past week 300 tons of pig iron arrived in this district from Millom.

Coal.

The Scottish coal market shows a firmer all-round tendency. The home and export demand for large coal has improved, and there is an upward movement in the prices of most descriptions. In the West of Scotland best splints are in a better position, owing to the receipt of South American orders. Lothians steams are firmer, though supplies are still fairly well maintained. On the other hand, exporters find some difficulty in securing deliveries of Fifeshire steams, especially Cowdenbeath quality. Supplies of large fuels are likely to become more scarce, owing to further restriction of the output under the quota system. Already two Fifeshire pits have been closed in order to avoid producing in excess of the owner's quota. Under the circumstances, business is even more of a day-to-day character, neither collieries nor exporters being disposed to take any risks. In all districts the strength of washed nuts is the principal feature, with Fifeshire treble nuts outstanding, these being now quoted up to 18s. per ton. Aggregate shipments amounted to 256,191 tons, compared with 263,638 tons in the preceding week and 246,632 tons in the same week last year.

WALES AND ADJOINING COUNTIES.

(From our own Correspondent.)

The Coal Trade.

THERE is both disappointing and encouraging news about the coal trade of this district. The Customs returns of coal exports for the month of September came somewhat as a surprise. It was not thought for one moment that the total would be only 1,187,955 tons, which was the lowest for any month of this year. The August total was recognised as poor at 1,339,343, but it was not regarded as possible that the figures for September would be even lower. One hesitates to forecast that the returns for the present month will display any recovery for the reason that the weekly figures of late have not been good. Certainly tonnage has been thrown much out of position of late by the bad weather, and this may be partly responsible for the returns for last week not being better, but in addition to this there has not been much chartering of large-sized tonnage. Orders on the market for moderate-sized steamers have been more numerous, but these have scarcely made up for the lack of what might be termed "big" business. Anthracite shipments marked an improvement, which was not surprising in view of the fact that at one time last week there were about a dozen vessels waiting to get into berth, whereas at the steam coal loading ports there were, as usual, many idle tipping appliances. Still the position in this respect at the ports between Newport and Port Talbot has improved a shade, as on Monday the total was twenty-nine, whereas on Saturday the number was forty-two. The news from Spain is more cheerful after all the reports of that country's intention further to limit the importation of foreign coals. At the end of last week the South Wales Coal Exporters' Association received a cablegram from Madrid to the effect that, in reply to questions in the Spanish Chamber, the Government stated definitely that there was no intention of further restricting imports of British coal. More detailed information is awaited, as naturally exporters are interested to know whether this means that Spanish railways are not to be compelled to use native coal as was reported, recently. The report has also been received from abroad that the Italian Government intended to resume taking deliveries of Welsh coals for the Italian State Railways under the Hague agreement, but this report has received no confirmation on this side. A subject that has aroused considerable interest is the draft scheme issued to all the districts by the Central Executive Committee set up under the Coal Mines Act, 1930, proposing a levy of 3d. or 6d. per ton on production in aid of the export trade. Inasmuch as South Wales is primarily an exporting area there is a great deal of support forthcoming in favour of the scheme. The South Wales coalowners will meet shortly to consider it. Sir David Llewellyn is in favour of the idea and points out that this is the only important export country where a system of this kind is not in operation. An extra 6d. per ton on the price of inland coal would yield about 2s. per ton for exports, which would be of immense benefit in competing for foreign orders. Labour leaders also express their approval that something on these lines is going to be done, but home consumers will not be so enthusiastic about it, naturally, though it is pointed out that in the long run they should be recouped by lower taxation and in other directions.

The Ottawa Pact.

Details of the Ottawa Agreements have been received with a certain amount of satisfaction in this area, but caution is displayed as to what the ultimate result will be. The leaders of industry are looking forward to increased trade with the Dominions, and there appears to be a feeling that the tin-plate and iron and steel industries should benefit, but at the same time it is pointed out by one leading authority that so far as the tin-plate trade is concerned Empire markets account for only roughly one-third of their exports, and the question arises how will their important customers in foreign countries view the Agreement. As remarked by the Swansea Divisional Officer of the Iron and Steel Trades Confederation (Mr. Morgan E. Rees), the Agreement, regarded sectionally, is going to be an advantage to the steel and tin-plate industries, but it is in the light of its general effect that one has got to judge it.

Miscellaneous Items.

The Ferry Tin-plate Works at Briton Ferry made a re-start on Monday after being idle for some weeks, when three mills out of four were set going. The finishing departments will follow suit next week. The Grovesend Tin-plate Works, Gorseinon, re-started operations on Tuesday with nine mills, after being idle for about three months. At the end of last week the anthracite Big Vein seam at the new Cefn Coed Colliery in the Vale of Neath was struck in the South Pit and the coal has been proved to be of high quality. This is the newest colliery in the coalfield, and belongs to the Amalgamated Anthracite Collieries, Ltd. The South Pit is to be developed as rapidly as possible to meet the demand for anthracite. The Executive Committee of the South Wales Regional Industrial Development Council has appointed as secretary Mr. David John Davies, a well-known Cardiff docksman, who is well acquainted with both the export and import sides of this district's trade. The Executive Council of the South Wales Miners' Federation has convened a special delegate conference for November 21st to deal with the necessary revision of rules in connection with the scheme for the reorganisation of the Federation. It is reported that definite progress has been made with the scheme, which, on the whole, had been favourably received in the areas concerned. Its adoption means the merging of several of the existing districts, a scheme which has been found necessary in view of the reduction in the number of men employed in the coalfield.

Current Business.

Operations from day to day have been to all appearances on the quiet side, but there is evidence of business for the near trades being well maintained. Large coals are definitely slow to meet with an improved demand, but for sized qualities, especially those of low volatile content, there is a pressing demand and prices are firm. Up to 31s. is quoted for dry nuts, and this figure is largely nominal as supplies for prompt shipment are practically unobtainable. Patent fuel is well stemmed and coke remains without change, but pitwood is not so freely offered and prices have moved up to 21s. to 22s.

BRITISH STANDARDS INSTITUTION.

All British Standard Specifications can be obtained from the Publications Department of the Institution at 28, Victoria-street, London, S.W. 1. The price of each specification is 2s. 2d. post free, unless otherwise stated.

LIGHT RAIN WATER PIPES.

No. 460—1932. This is the sixth British Standard Specification of a series dealing with Cast Iron Pipes for Water, Gas, and Sewage, No. 78; Drainage, No. 437; Low-pressure Heating, No. 40; Flue or Smoke, No. 41; Soil, Waste, Ventilating and Heavy Rain Water, No. 416; Light Rain Water, No. 460. It represents the first step towards national standardisation in light rain water goods, and whilst straight pipes only are dealt with at present, it is hoped in future editions to provide for the corresponding fittings and gutters, thereby covering the whole range of cast iron rain water goods.

WIRE ROPE TERMINAL ATTACHMENTS.

Nos. 461—1932, 462—1932, 463—1932, 464—1932. Safety in lifting not only demands the use of a good quality wire rope, but if satisfactory life and useful service are to be obtained, it is essential that suitable and reliable terminal fittings should be used and that the rope should be connected to them in an efficient manner.

In the preparation of these four specifications particular attention has been given in certain instances to specifying essential dimensions, but only such as are necessary to obtain suitable fittings which are of adequate strength and, where necessary, interchangeable. Where strength was the sole consideration minimum dimensions have been given. By so doing manufacturers have scope to adapt their individual patterns to improve design and future development, and improvement will not be precluded. The specification for Thimbles, No. 464, provides for three types—ordinary, reeving and solid—and the specification for Sockets, No. 463, provides for two types, open and closed. In the latter case the basket of the socket is identical, modification being only to that end of the socket which takes a shackle, link or other attachment. The remaining specifications, Nos. 461 and 462, deal respectively with Bordeaux Connections and Bull Dog Grips. Full recommendations as to the manner in which the various fittings should be attached to the wire ropes are given in appendices to all the specifications. The prescription for splicing the Bordeaux Connection is fully detailed, and is considered to be a model of its kind.

ELECTRIC LAMPS FOR RAILWAY SIGNALLING.

No. 469—1932. The general clauses of this specification defining the tests on the lamps are in line with the corresponding clauses of B.S. Specification No. 161. Special clauses deal with the suitability of the various lamps for particular signalling purposes, and then follow schedules giving the rating, dimensions, efficiency and life of the lamps. An appendix showing in graphical form the relation between the voltage, life and efficiency of the lamps is included.

LAUNCHES AND TRIAL TRIPS.

CHANGKIANG, train ferry; built by Swan, Hunter and Wigham Richardson, Ltd., to the order of Chinese Government Purchasing Commission; dimensions, 372ft. by 58½ft.; to carry passenger and freight trains across the Yangtse River between Nanking and Pukow. Engines, triple-expansion; constructed by the builders; launch, October 12th.

THE ALSACE CANAL AND KEMBS POWER STATION.—In an article in our issue of August 26th on the above-named canal and power station we stated, on the strength of information received from the undertakers, that "Practically all the machinery for excavating the canal was supplied by German firms." The Bucyrus-Erie Company, of S. Milwaukee, takes exception to this statement and informs us that it supplied two large electric dragline excavators and two smaller steam shovels. As the total number of large mechanical excavators used on the works was eleven and as the Bucyrus-Erie Company supplied four machines, it follows that that company was responsible for 36¼ per cent. of that plant.

SHIPBREAKING SCRAP ANOMALY.—Speaking at a meeting of Thos. W. Ward, Ltd., Albion Works, Sheffield, some days ago, the chairman, the Master Cutler (Mr. Joseph Ward) mentioned the strange anomaly that an Englishman cannot purchase a foreign ship and bring it into this country without paying duty, but the foreigner can break up the ship in his own country—having the advantage of less wages and longer hours—at a very much lower cost than the work can be done for here; he can then send the resultant scrap into this country and, under existing conditions, it is admitted free, thus increasing unemployment and allowing money to go out of the country for goods of which there is an ample tonnage available here at very low prices.

Current Prices for Metals and Fuels.

IRON ORE.

N.W. Coast—	
(1) Native	16/6 to 20/–
(1) Spanish	17/– to 23/6
N.E. Coast—	
Native	18/– to 21/–
Foreign (c.i.f.)	14/6

PIG IRON.

	Home. £ s. d.	Export. £ s. d.
(2) Scotland—		
Hematite	3 7 6	—
No. 1 Foundry	3 10 0	—
No. 3 Foundry	3 7 6	—
N.E. Coast—		
Hematite Mixed Nos.	2 19 0	2 19 0
No. 1	2 19 6	2 19 6
Cleveland—		
No. 1	3 1 0	3 1 0
Siliceous Iron	3 1 0	3 1 0
No. 3 G.M.B.	2 18 6	2 18 6
No. 4 Foundry	2 17 6	2 17 6
No. 4 Forge	2 17 0	2 17 0
Mottled	2 16 6	2 16 6
White	2 16 6	2 16 6
Midlands—		
(c) Staffs.—	(*Delivered to Station.*)	
All-mine (Cold-blast)	—	—
North Staffs. Forge	3 1 0	—
„ „ Foundry	3 6 0	—
(c) Northampton—		
Foundry No. 3	3 2 6	—
Forge	2 17 6	—
(c) Derbyshire—		
No. 3 Foundry	3 6 0	—
Forge	3 1 0	—
(3) Lincolnshire—		
No. 3 Foundry	—	—
No. 4 Forge	—	—
Basic	—	—
(4) N.W. Coast—		
N. Lancs. and Cum.—		
Hematite Mixed Nos.	3 15 6 (*a*) / 4 0 6 (*b*) / 4 5 6 (*c*)	—

MANUFACTURED IRON.

	Home. £ s. d.	Export. £ s. d.
Scotland—		
Crown Bars	9 15 0	9 5 0
Best	—	—
N.E. Coast—		
Iron Rivets	11 5 0	—
Common Bars	9 5 0	—
Best Bars	10 5 0	—
Double Best Bars	10 15 0	—
Treble Best Bars	11 5 0	—
Lancs.—		
Crown Bars	9 15 0	—
Best Bars	10 5 0	—
Hoops	12 0 0	—
S. Yorks.—		
Crown Bars	9 15 0	—
Best Bars	10 15 0	—
Hoops	12 0 0	—
Midlands—		
Crown Bars	9 0 0 to 9 15 0	—
Marked Bars (Staffs.)	12 0 0	—
Nut and Bolt Bars	8 0 0 to 8 10 0	—
Gas Tube Strip	10 7 6 to 10 10 0	—

STEEL. (*d*)

	(6) Home. £ s. d.	(7) Export. £ s. d.
(5) Scotland—		
Boiler Plates (Marine)	9 0 0	8 10 0
„ „ (Land)	—	—
Ship Plates, ½in. and up	8 15 0	7 15 0
Sections	8 7 6	7 7 6
Steel Sheets, ¼in.	7 15 0	7 15 0
Sheets (Gal. Cor. 24 B.G.)	11 0 0	10 15 0

STEEL (*continued*).

	Home. £ s. d.	Export. £ s. d.
N.E. Coast—		
Ship Plates	8 15 0	7 15 0
Angles	8 7 6	7 7 6
Boiler Plates (Marine)	10 10 0	—
„ „ (Land)	10 0 0	—
Joists	8 15 0	7 7 6
Heavy Rails	8 10 0	—
Fish-plates	12 0 0	—
Channels	10 5 0	£9 to £9 5s.
Hard Billets	7 2 6	—
Soft Billets	5 10 0	—
N.W. Coast—		
Barrow—		
Heavy Rails	8 5 0	—
Light Rails	8 10 0 to 8 15 0	—
Billets	6 10 0 to 9 0 0	—
Manchester—		
Bars (Round)	9 7 6	—
„ (Small Round)	6 15 0 to 7 0 0	—
Hoops (Baling)	10 0 0	9 15 0
„ (Soft Steel)	9 0 0	8 15 0
Plates	8 17 6 to 9 2 6	—
„ (Lancs. Boiler)	8 10 0 to 8 12 6	—
Sheffield—		
Siemens Acid Billets	9 2 6 (basis)	—
Hard Basic	8 2 6 and 8 12 6	—
Intermediate Basic	6 12 6 and 7 2 6	—
Soft Basic	5 15 0	—
Hoops	9 10 0 to 9 15 0	—
Soft Wire Rods	7 10 0	—
Midlands—		
Small Rolled Bars (all British)	7 0 0 to 7 5 0	—
Small Re-rolled Bars	6 7 6 to 6 10 0	—
Billets and Sheet Bars	4 17 6 to 5 7 6	—
Galv. Sheets, f.o.b. L'pool	10 0 0	—
(2) Staffordshire Hoops	9 10 0	—
(*d*) Angles	8 7 6	—
(*d*) Joists	8 15 0	—
(*d*) Tees	9 7 6	—
(*d*) Bridge and Tank Plates	8 17 6	—
Boiler Plates	8 7 6 to 8 10 0	—

NON-FERROUS METALS.

Swansea—		
Tin-plates, I.C., 20 by 14	f.o.b.	15/9 to 16/–
Block Tin (cash)		153 0 0
„ (three months)		153 7 6
Copper (cash)		31 12 6
„ (three months)		31 16 3
Spanish Lead (cash)		11 11 3
„ „ (three months)		11 15 0
Spelter (cash)		14 10 0
„ (three months)		14 15 0
Manchester—		
Copper, Best Selected Ingots		35 10 0
„ Electrolytic		37 0 0
„ Strong Sheets		65 0 0
„ Tubes (Basis Price), lb.		0 0 10
Brass Tubes (Basis Price), lb.		0 0 9
„ Condenser, lb.		0 0 11½
Lead, English		13 10 0
„ Foreign		11 17 6
Spelter		14 15 0
Aluminium (per ton—raw ingot)	£95	

FERRO ALLOYS.

	Per Ton.	Per Unit.
Tungsten Metal Powder	1/10½ per lb.	
Ferro Tungsten	1/7½ per lb.	
Ferro Chrome, 4 p.c. to 6 p.c. carbon	£25 15 0	8/–
„ „ 6 p.c. to 8 p.c.	£24 10 0	7/6
„ „ 8 p.c. to 10 p.c.	£22 5 0	7/–
„ „ Specially Refined		
„ „ Max. 2 p.c. carbon	£36 10 0	11/–
„ „ „ 1 p.c. carbon	£42 12 0	14/–
„ „ „ 0·70 p.c. carbon	£44 0 0	16/–
„ „ „ carbon free	1/– per lb.	
Metallic Chromium	2/9 per lb.	
Ferro Manganese (per ton)	£10 15 0 for home	
„ „ „	£9 15 0 for export	
„ Silicon, 45 p.c. to 50 p.c.	£13 10 0 unit	scale 5/– per
„ „ 75 p.c.	£19 10 0 unit	scale 6/– per
„ Vanadium	12/6 per lb.	
„ Molybdenum	6/3 per lb.	
„ Titanium (carbon free)	9d. per lb.	
Nickel (per ton)	£245 0 0	
Ferro Cobalt	7/9 per lb.	

FUELS.

SCOTLAND.

	Export.
Lanarkshire—	
(f.o.b. Glasgow)—Steam	12/6
„ „ Ell	14/–
„ „ Splint	13/9 to 15/3
„ „ Trebles	14/6 to 15/–
„ „ Doubles	12/6
„ „ Singles	10/6 to 10/9
Ayrshire—	
(f.o.b. Ports)—Steam	11/6
„ „ Jewel	16/6
„ „ Trebles	14/6
Fifeshire—	
(f.o.b. Methil or Burntisland)—Steam	11/– to 13/6
Screened Navigation	16/6
Trebles	16/6 to 18/–
Doubles	12/6 to 14/–
Singles	10/6 to 11/–
Lothians—	
(f.o.b. Leith)—Best Steam	11/6 to 12/–
Secondary Steam	11/–
Trebles	14/6
Doubles	12/– to 13/–
Singles	10/6 to 10/9

(8) N.W. Coast— ENGLAND.

Steams	21/–
Household	32/6 to 52/6
Coke	19/– to 22/6
Northumberland—	
Best Steams	13/6
Second Steams	12/3 to 12/6
Steam Smalls	8/6
Unscreened	12/6 to 13/–
Household	27/– to 39/–
Durham—	
Best Gas	14/6
Second	13/3 to 13/6
Household	25/– to 37/–
Foundry Coke	24/–

Sheffield—	Inland.
Best Hand-picked Branch	27/– to 28/–
South Yorkshire Best	23/– to 24/–
South Yorkshire Seconds	19/– to 21/–
Derbyshire Best House	22/– to 23/6
Derbyshire Best Brights	18/– to 20/–
Screened House Coal	18/– to 19/–
Kitchen Coal	16/– to 17/6
Best Screened Nuts	16/6 to 18/6
Small Screened Nuts	15/6 to 16/6
Yorkshire Hards	17/– to 18/–
Derbyshire Hards	17/– to 18/–
Rough Slacks	8/6 to 9/6
Nutty Slacks	7/– to 8/6
Blast-furnace Coke (Inland)	10/– on rail at ovens
Furnace and Foundry Coke (Export), f.o.b., 14/6 to 15/6	

Cardiff— (9) SOUTH WALES.

Steam Coals :	
Best Smokeless Large	19/6 to 19/9
Second Smokeless Large	18/9 to 19/6
Best Dry Large	19/– to 19/6
Ordinary Dry Large	17/9 to 18/3
Best Black Vein Large	18/3 to 18/6
Western Valley Large	17/9 to 18/–
Best Eastern Valley Large	17/7½ to 17/9
Ordinary Eastern Valley Large	17/3 to 17/6
Best Steam Smalls	13/– to 13/6
Ordinary Smalls	11/– to 13/–
Washed Nuts	19/– to 31/–
No. 3 Rhondda Large	19/6 to 19/9
„ „ Smalls	15/– to 16/–
No. 2 „ Large	17/– to 17/3
„ „ Through	15/6 to 16/–
„ „ Smalls	14/– to 14/3
Foundry Coke (Export)	22/6 to 36/6
Furnace Coke (Export)	17/– to 18/–
Patent Fuel	20/–
Pitwood (ex ship)	21/6 to 22/–

Swansea—

Anthracite Coals :	
Best Big Vein Large	36/– to 38/6
Seconds	27/– to 34/–
Red Vein	22/– to 26/6
Machine-made Cobbles	37/6 to 48/6
Nuts	36/6 to 48/6
Beans	28/6 to 32/6
Peas	19/6 to 21/–
Breaker Duff	8/6 to 9/6
Rubbly Culm	10/6 to 10/9
Steam Coals :	
Large	20/– to 20/6
Seconds	18/– to 20/–
Smalls	11/6 to 13/–
Cargo Through	16/– to 17/6

(1) Delivered. (2) Net Makers' Works. (3) f.o.b. Makers' Works, approximate. (4) Delivered Sheffield. (5) Glasgow, Lanarkshire and Ayrshire. (6) Home Prices—All delivered Glasgow Station. (7) Export Prices—f.o.b. Glasgow. (8) Except where otherwise indicated, coals are per ton at pit for inland and f.o.b. for export, and coke is per ton on rail at ovens and f.o.b. for export. (9) Per ton f.o.b. (*a*) Delivered Glasgow. (*b*) Delivered Sheffield. (*c*) Delivered Birmingham. (*d*) Rebate : Joists (minimum), 22/6 ; Ordinary Ship, Bridge, and Tank Plates and Sections, 15/– if home consumers confine purchases from associated British Steel Makers. (*e*) Delivered Black Country Stations.

French Engineering Notes.

(From our own Correspondent in Paris.)

Rhone Navigation Works.

THE Compagnie Nationale du Rhône has been definitely constituted with a fully subscribed capital of 240 million francs, and will now take over the concession for the works to be carried out to render the Rhône navigable from the Swiss frontier to the Mediterranean, together with the construction of dams and hydro-electric power stations and the installation of pumping plants for the irrigation of a vast extent of arid land in the south of France. The company states that it is prepared to begin work and provide employment for a considerable number of men as soon as the plans are sanctioned. These plans have been prepared by a technical committee, and are still subject to modifications, for the scheme introduced many complicated factors, and its complete realisation depends upon Switzerland raising the level of the Lake of Geneva in order to render navigation possible on the first section of the river from the lake to Seyssel, and thereby allow of traffic between Switzerland and the Mediterranean. The proposed construction of a canal between the Lake of Geneva and Lake Neufchâtel would then permit of direct traffic with the inland port of Basle. So far, Switzerland has been opposed to any idea of raising the level of the Lake of Geneva, but negotiations to that end are still proceeding, and if the lake can provide a minimum of 200 cubic metres a second during the five dry months of the year the whole aspect of the problem will be changed. Without this additional supply the river cannot be rendered navigable for big boats over its full distance, and the velocity of the current is a serious impediment, for which reason the construction of lateral canals along some of the sections appears to offer the only solution of the problem. The Marseilles Chamber of Commerce insists upon that solution being adopted without further hesitation. Apart from the traffic, which is necessarily an uncertain factor in the economy of the scheme, the company expects to obtain profit chiefly from the hydro-electric plants which will have a total minimum capacity of 560,000 kW. Until the plan is finally settled, there is nothing to prevent the company from working on the section between Lyons and Arles.

Automatic Couplings.

The equipment of rolling stock with automatic couplings on all the Continental railways has been urged with particular insistence by the International Labour Bureau at Geneva, which last year secured the appointment of a committee with representatives of Governments, railway companies, and railwaymen to examine a proposal to create an international fund for carrying out tests of automatic devices. The arguments in favour of automatic couplings are declared to be so strong from the point of view of safety to railwaymen and economy to the railway companies, and of providing employment for something like 320,000 men, outside Russia, for a period of five years, that everyone at Geneva was favourable to any measure that would allow of the necessary experimental work being carried out. No railway company is able to bear the heavy cost of these experiments, which have to be extended over fairly long periods with a large number of couplings, and it was admitted at Geneva that the only way to deal with the matter was for the different Governments to finance a common fund for an experimental service which would be in the hands of a representative committee under the immediate control of all the interests concerned. Last year a delegate from the German railways declared that satisfactory trials had been carried out with a new coupling that fulfilled all the required conditions with very little change to existing rolling stock. There are several other types of couplings that are waiting to be tested. The committee formed last year to examine the proposal to ask the various Governments to contribute to a fund has just presented a report in favour of the idea, and it will be discussed at the International Labour Conference being held in Madrid this week. These efforts to introduce automatic couplings on all the Continental railways cannot be expected to produce early results, for the selection of types of apparatus acceptable to all the railway companies is likely to be a long and tedious work, and means will then have to be found to finance the equipment of rolling stock.

Unemployed Miners.

The increased coal production in this country has only been made possible by the importation of foreign labour, which was at one time almost exclusively Belgian, and has since the war been supplemented by Poles who have settled in their thousands in the Nord and the Pas de Calais. As the situation of the coal trade is becoming more and more serious on account of the steady fall in the consumption of coal for industrial purposes, the only variety produced at the French collieries, the Government is reported to have the intention of averting the danger of throwing more French miners out of work by sending foreign miners back to their respective countries. The Miners' Union in the Pas de Calais protests against the exclusion of foreign workers, on the ground that any restriction of output through a reduction in the number of men employed, while overhead charges remain the same, must have the effect of increasing the cost of coal, and the Socialist Union follows up this argument by declaring that it objects on principle to the deportation of foreign miners. It insists that the duty of the Government is to do whatever is necessary to help the industry in such a way as to provide work for all the men.

Import Tax.

When the French Government raised the 2 per cent. tax on imports to 4 and 6 per cent. a few months ago, there was immediate retaliation from other countries, which imposed similar taxes on French goods. The effect has been so serious on the French export trade that the Government is being called upon to allay irritation abroad by suppressing the tax. It is also suggested that manufacturers and traders would benefit from the economic warfare on the Continent if France were to enter into friendly commercial relations with the different opponents.

British Patent Specifications.

When an invention is communicated from abroad the name and address of the communicator are printed in italics.

When an abridgment is not illustrated the Specification is without drawings.

Copies of Specifications may be obtained at the Patent Office, Sale Branch, 25, Southampton-buildings, Chancery-lane, W.C., at 1s. each.

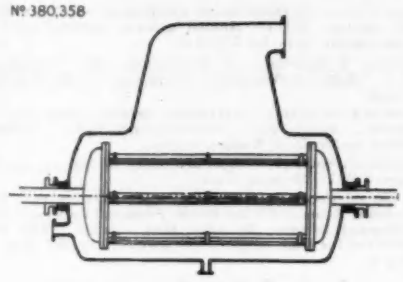
The date first given is the date of application; the second date, at the end of the abridgment, is the date of the acceptance of the complete Specification.

CONDENSERS AND FEED-WATER HEATERS.

380,358. February 23rd, 1932.—SCALING EVAPORATOR TUBES, Société des Condenseurs Delas, 103, rue St. Lazare, Paris, France.

In order to keep the heating surface of the tubes of an evaporator clear of scale, the tubes are arranged in the form of

Nº 380,358



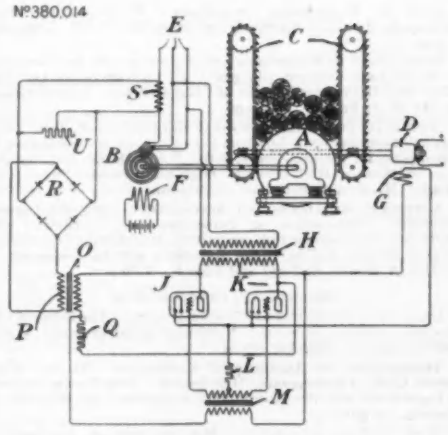
a squirrel cage, and each tube is surrounded by another tube of about twice its diameter. The outside tubes are threaded on loosely and are perforated. As the squirrel cage is rotated the outside tubes roll on the heating tubes and break off the scale to fall into the bottom of the evaporator.—*September 15th*, 1932.

DYNAMOS AND MOTORS.

380,014. April 13th, 1932.—ELECTRIC MOTOR CONTROL SYSTEMS, *The British Thomson-Houston Company, Ltd., of Crown House, Aldwych, London, W.C.2.*

An object of this invention is to provide an improved electric control system for motor-driven machines adapted to operate on continuously fed material which will be simple and reliable in operation and by means of which any desired fineness of regulation may be secured. The invention is shown applied to a pulp-grinding mechanism comprising a main grinding mechanism A driven by means of a direct-connected synchronous motor B and a feeding mechanism C driven by means of an auxiliary variable-speed, direct-current motor D. The synchronous motor B is connected to the alternating-current circuit E, and is provided with a field winding F. The variable-speed motor D is provided with a field winding G, which is connected to be energised from the alternating-current circuit E through a controlled rectifier, comprising a transformer H and electric valves J and K, connected for full-wave rectification. The grids of these valves are connected to the common cathode circuit through a current-limiting resistor L, and opposite halves of the secondary winding of the grid transformer M. In order to control the output of the rectifier in accordance with the load on the motor B, and thus control the excitation of the feed motor D, an impedance phase-shifting circuit is provided, comprising a saturable reactor O provided with a saturating winding P and a resistor Q connected in series across the secondary winding of the transformer H. The saturating winding P is energised through a rectifier bridge R from the secondary

Nº 380,014



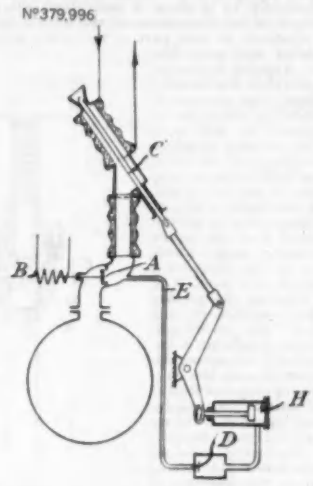
winding of the current transformer S. If desired, a variable resistor U may be connected across the secondary winding of this transformer, in order to secure various regulating characteristics in accordance with the type of material to be operated upon. Let it be assumed that the phase of the grid potentials of electric valves with respect to the anode potentials of these valves is such that the average current delivered by the rectifier arrangement is just sufficient to maintain constant the desired speed of the motor D to maintain a constant load upon the main driving motor B. In case the motor B tends to become overloaded, owing to a change of the type of materials upon which the grinding mechanism is operating or for any other cause, the output of the current transformer S will increase, and correspondingly increase the saturation of reactor O. As the saturation of reactor O increases and its reactance decreases, the phase of the potential between the midpoints of the phase-shifting circuit, which is applied to the primary winding of grid transformer M will advance with respect to the potential of the secondary winding of the transformer H, *i.e.*, with respect to the anode potentials of electric valves J and K, so that the average output of the rectifier arrangement is increased. An increase in the output of the rectifier arrangement increases the excitation of the field winding G of the variable-speed motor D, with the result that the speed of this motor is decreased. It will be apparent that a decrease in the speed of the feed motor D will decrease the rate at which material is fed to the grinding mechanism A, with the result that the load on the motor B will be correspondingly decreased.—*September 8th*, 1932.

SWITCHGEAR.

379,996. March 10th, 1932.—ELECTRIC GAS BLAST SWITCHES, *International General Electric Company, Inc., of 120, Broadway, New York, U.S.A.*

In a gas blast switch in which compressed gas is admitted to the switch by means of a single valve for the purpose of extinguishing the arc and for operating the contacts, means are provided in accordance with the invention which are responsive to the circuit current for closing the valve as soon as the arc is extinguished and which ensure that the opening operation of the switch is completed in the event of the arc being extinguished before the contacts are fully opened. When the operat-

Nº 379,996



ing coil B is energised, the circuit current opens the valve A, and when de-energised on the opening of the main switch, it allows the valve to close again. In order to ensure that in the event of the valve A closing before the contact C has completed its full opening movement, that opening movement shall be completed, a valve D is inserted in the pipe connection E, and closes in response to the reduction in pressure of the compressed gas due to the opening of the contacts, whereby compressed gas is entrapped in the cylinder H. Should this amount of gas be insufficient to complete the opening operation an auxiliary reservoir may be inserted in the pipe E as shown.—*September 8th*, 1932.

TRANSMISSION OF POWER.

380,346. February 2nd, 1932.—FRICTION COUPLINGS, P. A. Scott-Iversen, Frederiksholm Kanal 16, Copenhagen, Denmark.

In this arrangement power is transmitted from the shaft A to the driven shaft B through the back gear C and the friction discs D, E. The final wheel F of the back gear has a free-wheel action on the shaft B, while the primary wheel is mounted on a sleeve which surrounds B. The two friction discs are arranged

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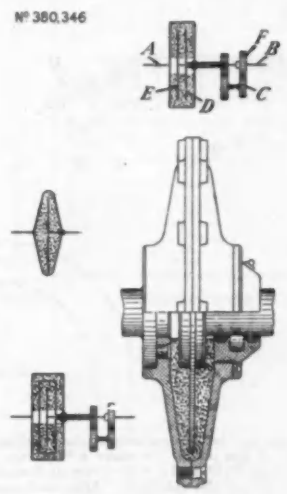

in a circular casing on the end of the driving shaft, which is almost filled with some granular material. On starting up the driving shaft, the driven shaft is gradually got under way by the frictional drag on the disc E, acting through the gearing C. As speed is gathered the centrifugal force developed by the filling of the disc casing becomes sufficient to bind the whole mechanism together and there is a direct drive.—*September 15th*, 1932.

MACHINE TOOLS AND SHOP APPLIANCES.

379,978. February 10th, 1932.—BROACHES, *W. W. Triggs, 57, Lincoln's Inn-fields, London, W.C.2.*

The object of this broach is to break through, immediately at the start of the cut, the hard surface layer of the metal

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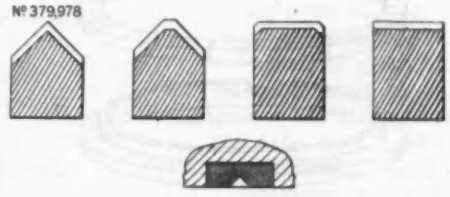


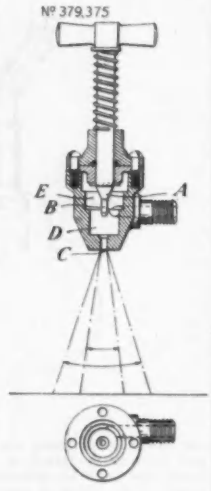
and then to open out the cut sideways by a transverse slicing process. Thus, to make a rectangular groove the early teeth of the broach are made triangular and the triangle is gradually truncated until it becomes a rectangle at the end of the stroke.

It is claimed that much less strain is imposed on the broach than with the usual arrangement of teeth with gradually increasing depth.—*September 8th*, 1932.

MISCELLANEOUS.

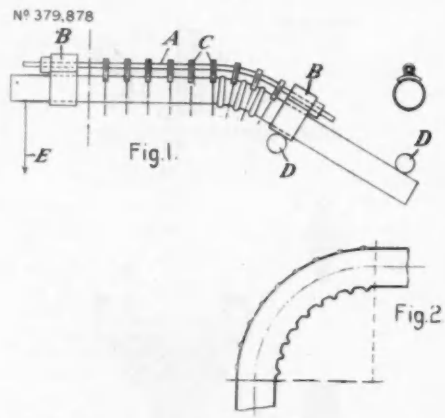
379,375. May 29th, 1931.—Sprays for Froth Killing, the Watford Engineering Works, Ltd., Lower High-street, Watford; J. Paramour, 6, Kingsfield-road, Watford, and C. H. Kenny, 1, Cross-road, Watford.

This spray is intended for froth killing in paper-making machines. It is pointed out that the usual jet produces a hollow conical spray, so that it is only effective round its circumference. The inventors' jet is of that form in which the water is introduced tangentially to produce a centrifugal effect, but the interior is made of two diameters and the inlet is drilled at the change of diameter, so that part of the water flows into the larger chamber and part into the smaller. A spring-controlled pricker is provided for clearing the jet orifice. On account of the difference in diameter of these chambers D and E, a difference in whirling speed of the water is produced, which, in turn, causes a difference of centrifugal force in the two chambers. When the water is turned on, the whirling action causes the water to issue from the outlet C in a rotating spray, which spreads out to the shape of a substantially hollow cone. The faster the whirling the greater becomes the diameter of this cone. When the centrifugal force reaches its maximum in the upper chamber E, it opposes the entry of water because the centrifugal force approaches that of the head of water. This results in the lower chamber D being partially starved and emptied, causing a diminished whirling speed of the water and, hence, a reduction in the diameter of the cone of spray. When the lower chamber D empties water is permitted to rush from the upper chamber E down into the lower chamber D and the cycle of operation recommences. The cone A and pricker B act as a guide to the water in starting its circular whirling motion and also the position of the cone determines the amount of water in the upper of the two chambers and, consequently, the centrifugal force opposed to the inflow. If the device is used with a working pressure of, say, 15 lb. to 20 lb. per square inch in conjunction with apparatus of the proportions illustrated, a cone of spray is obtainable, which alternately expands and contracts from an angle of approximately 15 deg. to an angle of approximately 60 deg., so that the jet of spray repeatedly traverses the area of surface under treatment.—*August 29th*, 1932.



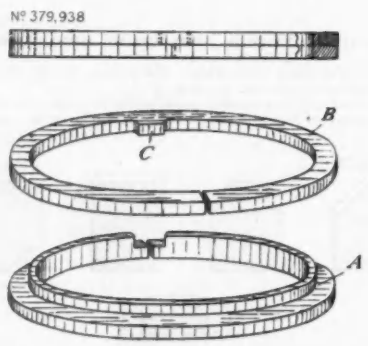
379,878. September 24th, 1931.—A Method of Bending Pipes, W. Kossowski, Pieknastr 4, Warsaw, Poland.

In order to bend pipes without it being necessary to fill them, to prevent collapse, the inventor securely attaches to the outside of the bend a wire rope A, which is fixed by the clips B, B, and is held in position by the saddles C. This rope has the effect of displacing the neutral axis of the combination outside the diameter of the pipe. To make a bend the pipe is held between the stops D, D, and is pulled over at E while it is heated successively between the saddles C. After each successive bend the wire rope is slacked off very slightly. The result is a bend of the character shown in Fig. 2.—*September 8th*, 1932.



379,938. December 10th, 1931.—Piston Rings, C. C. Pounder, Queen's Island, Belfast, and F. E. Rebeck, Queen's Island, Belfast.

This is a compound piston ring in which all the radial faces are flat and without projections, so that they can be ground quite true. The primary ring A is of flange-like form, while the secondary ring B is plain. Both are split and a projection C on the secondary ring fits into a gash cut in the primary ring to keep the two in mutual position.—*September 8th*, 1932.



Forthcoming Engagements.

Secretaries of Institutions, Societies, &c., desirous of having notices of meetings inserted in this column, are requested to note that, in order to make sure of its insertion, the necessary information should reach this office on, or before, the morning of the Tuesday of the week preceding the meetings. In all cases the TIME *and* PLACE *at which the meeting is to be held should be clearly stated.*

To-day.

Faraday House Old Students' Association.—Savoy Hotel, London, W.C.2. Twenty-fourth annual dinner. 6.30 p.m. for 7 p.m.

Inst. of Electrical Engineers: N.E. Students.—Armstrong College, Newcastle-upon-Tyne. "Construction of Large A.C. Generators," Mr. E. Yeeles. 7.15 p.m.

Institution of Mechanical Engineers.—At Connaught Rooms, Great Queen-street, W.C.2. Annual dinner. 6.45 p.m. for 7.15 p.m.

Institution of Production Engineers.—Holborn Restaurant, London, W.C.1. Annual general meeting, 6.30 p.m.; annual dinner, 7 p.m. for 7.30 p.m.

Junior Institution of Engineers.—39, Victoria-street, S.W.1. "Notes on Windmill Construction," by Mr. Rex Wailes. 7.30 p.m.

North-East Coast Institution of Engineers and Shipbuilders.—Bolbec Hall, Newcastle-upon-Tyne. Presidential Address, by Mr. R. J. Walker. 6 p.m.

Physical Society.—Imperial College of Science and Technology, S.W.7. Meeting, 5 p.m.

West of Scotland Iron and Steel Institute.—In the "Societies Room," No. 24, Royal Technical College, Glasgow. Presidential Address, Mr. John Bird; paper, "The Testing of Material for High-temperature Service," by Mr. Wm. Barr. 7.15 p.m.

To-day and Saturday, October 22nd.

International Motor Car and Motor Boat Exhibition.—Olympia, Kensington, W. Open daily, 10 a.m. to 10 p.m.

Saturday, October 22nd.

Institution of Heating and Ventilating Engineers: Associate Members' and Graduates' Section, Manchester and District Branch.—Visit to Mersey Tunnel, Liverpool.

Institution of Mechanical Engineers: Graduates' Section.—Visit to Neasden Power Station.

N. of England Inst. of Mining and Mechanical Engineers.—Newcastle-upon-Tyne. Further discussion, "Notes on a Few Unusual Occurrences of Inflammable and Noxious Gases in Mines," by Mr. A. M. Bryan. Papers, "Fossil Remains of Trees in the Roof of a Coal Seam," by Mr. Arthur Walker; "The Microstructure of the Coal in Certain Fossil Trees," by Prof. George Hickling and Mr. C. E. Marshall; a cinematograph film on "Arc-wall Machine Mining" will be exhibited and described by Mr. Arthur Walker. 2.30 p.m.

Monday, October 24th.

Bradford Technical College.—"Electric Arc Welding," E. F. Newell. 7.30 p.m.

Institution of Electrical Engineers.—Savoy-place, Victoria Embankment, W.C.2. Discussion, "The Future Prospect for Electrical Engineers." Opener, Professor E. W. Marchant. 7 p.m.

Inst. of Electrical Engineers: N. Eastern Centre.—Armstrong College, Newcastle-upon-Tyne. Chairman's Address, Mr. C. Turnbull. 7 p.m.

Institution of Mechanical Engineers: Graduates' Section.—London. "Experimental Work on a Marine Closed Feed System," by Mr. B. W. Pendred. 6.45 p.m.

Tuesday, October 25th.

British Association of Refrigeration.—In the Hall of the Institution of Mechanical Engineers, Storey's-gate, St. James's Park, S.W.1. Presidential Address by Sir William B. Hardy, F.R.S. 5.30 p.m.

Inst. of Electrical Engineers: N. Midland.—Hotel Metropole, Leeds. Chairman's address, Mr. R. M. Longman. 7 p.m.

Institution of Engineers and Shipbuilders in Scotland.—39, Elmbank-crescent, Glasgow, C.2. "A Note on the Development and Operating Results of 'Bauer-Wach' Installations," by Mr. R. J. Butler. 7.30 p.m.

National Technical Groups, Electrical Power Engineers' Association: London Local Group.—Junior Inst. of Engineers, 39, Victoria-street, S.W. "The Design and Installation of Modern High-pressure High-temperature Steam Pipe Work," Mr. J. Arthur Aiton. 7.15 p.m.

Sheffield Metallurgical Association.—198, West-street, Sheffield. "Discussion on Pyrometry" in connection with Section V., Pyrometric Sub-committee, fourth report on Heterogeneity of Steel Ingots. This discussion will be presented by Messrs. A. Stanfield, Todd and Elcock. 7.30 p.m.

Wednesday, October 26th.

Chartered Institute of Patent Agents.—The Edward VII. Rooms, Hotel Victoria, Northumberland-avenue, W.C.2. Jubilee dinner. 6.45 for 7 p.m.

Institution of Automobile Engineers.—At the Engineers' Club, Albert-square, Manchester. Presidential address, "Legislation and the Automobile Engineer," by Major C. G. Nevatt. 8 p.m.

Inst. of Civil Engineers: Manchester and District.—36, George-street, Manchester. "Shield Tunnelling," Mr. R. H. Falkiner. 6 p.m.

Inst. of Mechanical Engineers: Yorks. Branch.—University, Sheffield. "Causes of Brittle Fracture in Ductile Steels—or Metals," Prof. B. P. Haigh. 7.30 p.m.

Inst. of Welding Engineers.—College of Technology, Manchester. "Atomic Hydrogen Welding," Mr. J. Dorritt. 7.30 p.m.

Thursday, October 27th.

Inst. of British Foundrymen: Sheffield and District.—Works visit to Leys' Malleable Castings Company, Ltd., Derby.

Inst. of Locomotive Engineers.—Inst. of Mech. Engineers, Storey's-gate, S.W.1. "Some Observations on the Practice of Providing Lead with the Piston of Slide Valves of Modern Locomotives," Mr. C. A. Cardew. Mr. H. Holcroft will read the paper. 6 p.m.

Inst. of Mechanical Engineers: Yorks. Branch.—Hotel Metropole, Leeds. "Causes of Brittle Fracture in Ductile Steel—or Metals," Prof. B. P. Haigh. 7.30 p.m.

Inst. of Structural Engineers.—10, Upper Belgrave-street, S.W.1. Presidential address by Major E. C. P. Monson. Paper, "Dynamic Effects in Railway Bridges," Prof. C. E. Inglis. 6.30 p.m.

Manchester Association of Engineers: Students' Section.—Y.M.C.A. (Restaurant Club Room), Peter-street, Manchester. "A General Talk on Machine Tool Drives," by Mr. K. W. D. Roberts. 7.30 p.m.

North-East Coast Institution of Engineers and Shipbuilders: Tees-side Branch.—Cleveland Scientific and Technical Institution, Corporation-road, Middlesbrough. Address by the President, Mr. R. J. Walker; Chairman's address, Mr. W. T. Butterwick. 7.30 p.m.

Royal Aeronautical Society.—At the Royal Society of Arts, John-street, Adelphi, W.C.2. "Aeroplane Covers and Wheels," Mr. F. Fellowes. 6.30 p.m.

Friday, October 28th.

Inst. of Chemical Engineers.—At Inst. of Civil Engineers, Great George-street, S.W.1. First Hinckley Memorial Lecture. "Chemical Engineering and the Aircraft Industry," Mr. H. T. Tizard, F.R.S. 6.30 p.m.

Inst. of Electrical Engineers: London Students.—Savoy-place, W.C.2. "What of the Future? With Electro-farming as an Illustration," Mr. R. Borlase Matthews. 6.15 p.m.

Institution of Mechanical Engineers.—Storey's Gate, St. James's Park, S.W.1. General meeting, Presidential Address, by Mr. William Taylor. 6 p.m.

Junior Institution of Engineers.—39, Victoria-street, S.W.1. "Electrical Engineering as Applied to Theatres and Cinemas," by Mr. R. Gillespie Williams. 7.30 p.m.

Manchester Association of Engineers. Joint Meeting with North-Western Branch of Institution of Mechanical Engineers.—Engineers' Club, Albert-square, Manchester. "Transport in Modern Engineering Works," by Mr. J. S. Taylor. 7.15 p.m.

North-East Coast Institution of Engineers and Shipbuilders.—Bolbec Hall, Newcastle-upon-Tyne. First Andrew Laing Lecture. "The Work of Andrew Laing," by Engineer-in-Chief of the Fleet, Eng. Vice-Admiral Sir Reginald Skelton, K.C.B. 6 p.m.

Soc. of Consulting Marine Engineers and Ship Surveyors: Scottish District.—39, Elmbank-crescent, Glasgow, C.2. "Horizontal Balanced Slide Valve," Mr. James Andrews, 7 p.m.

Saturday, October 29th.

Institute of Metals: Birmingham Local Section.—Queen's Hotel, Birmingham. Dinner and dance. 7 p.m.

Monday, October 31st.

Bradford Engineering Society.—Technical College, Bradford. "Oil Firing for Steam-raising Purposes," by Mr. F. L. Bolt. 7.30 p.m.

Engineers' German Circle (Deutscher Ingenieurbezirkel in London).—At the Institution of Mechanical Engineers, Storey's-gate, St. James's Park, S.W.1. "Neue Konstruktionen von Dieselmotoren" ("New Designs of Diesel Engines"). Illustrated with lantern slides, by Diplom-Ingenieur R. E. Strub. 5.15 p.m. for 6 p.m.

Tuesday, November 1st.

North-East Coast Institution of Engineers and Shipbuilders: Graduates' Section.—Bolbec Hall, Newcastle-upon-Tyne. Résumé of Presidential Address by Mr. R. J. Walker. Paper, "Electric Steering Gears," by Mr. W. S. Paulin. 7 p.m.

Wednesday, November 2nd.

Institution of Automobile Engineers.—At the Queen's Hotel, Birmingham. Presidential address, "Legislation and the Automobile Engineer," by Major C. G. Nevatt. 7.30 p.m.

Institution of Heating and Ventilating Engineers.—In the Lecture Room at the Home Office Industrial Museum, Horseferry-road, Westminster, S.W.1. "Radiant Heat," by Mr. A. F. Dufton. 7 p.m.

Thursday, November 3rd.

Institution of Electrical Engineers.—Savoy-place, Victoria Embankment, W.C.2. "The Electric Lighting of Buildings," by Mr. A. B. Read and Dr. J. W. T. Walsh. 6 p.m.

Friday, November 4th.

British Science Guild.—Burton-on-Trent. Alexandra Pedler Lecture, 1932. "Animals as a National Asset and Responsibility," by Professor F. T. G. Hobday, C.M.G.

Chelsea Polytechnic.—Manresa-road, S.W.3. Opening building extension. Presentation of Diplomas and Certificates. 8 p.m.

Chemical Engineering Group.—Royal Technical College, Glasgow. "Ceramic Insulators: Their Manufacture and Testing," Mr. C. S. Garland. 7.30 p.m.

Institution of Mechanical Engineers.—Storey's-gate, St. James's Park, S.W.1. The Thomas Hawksley Lecture. "Atomic Projectiles and their Applications," by Professor Lord Rutherford, F.R.S. 6 p.m.

Institution of Production Engineers: London Section.—In the Council Room, Society of Motor Manufacturers and Traders, 83, Pall Mall, S.W.1. "Application of Various Steels," by Mr. J. W. Johnson. 7.30 p.m.

Inst. of Sanitary Engineers.—296, Vauxhall Bridge-road, S.W.1. "Guildford Corporation Waterworks Extensions, 1922–31," Mr. P. Griffith. 6 p.m.

Junior Inst. of Engineers.—39, Victoria-street, S.W.1. Informal meeting. 7.30 p.m.

Railway Club.—57, Fetter-lane, Fleet-street, E.C.4. "The Union of Road and Rail," by Mr. Edward Codd. 7.30 p.m.

Monday, November 7th.

Institution of Electrical Engineers.—Savoy-place, Victoria Embankment, W.C.2. Discussion, "The Present Depression—Is Electricity the Way Out?" Opener, Mr. F. J. Shipley. 7 p.m.

Society of Chemical Industry: London Section.—Burlington House, W.1. "Fermentation of Cellulose," by Mr. H. M. Langwell; "Examination of Asphalt Mixtures for Road Pavements," by Mr. Norman H. Taylor. (This paper will be presented by Professor M. G. Clements.) 8 p.m.

Wolverhampton and District Engineering Soc.—Victoria Hotel, Wolverhampton. "Design and Construction of Ironbridge Power Station," Mr. E. F. Hetherington. 7.30 p.m.

PERSONAL AND BUSINESS ANNOUNCEMENTS.

Burton, Griffiths and Co., Ltd., Montgomery-street, Sparkbrook, Birmingham, inform us that Mr. R. J. Macfarlane, who was for some time associated with Alfred Herbert, Ltd., in Scotland, has now joined their staff.

Beecroft and Partners, Ltd., Mappin-street, Sheffield, announce that they are now stockists for accessories and specialities in connection with the nitration process, issued by Nitralloy, Ltd., Norris Deakin Buildings, King-street, Sheffield.

Mr. H. Th. Holm, of the Bofors Steel and Armament Works, has been appointed chief of the L.M. Ericsson Telephone Company. His successor at the Bofors Works will be Dr. Sven Wingquist, previously managing director of the S.K.F., the Swedish ball bearing works.

The Manganese Bronze and Brass Company, Ltd., informs us that, following the death of its managing director, Mr. James C. Gray, on September 15th, Mr. James Clifton Colquhoun has been appointed chairman, and Messrs. E. Andrew Mearns and Bernard P. R. Parsons managing directors.